SOIL SURVEY OF

Sheridan County, Montana

United States Department of Agriculture
Soil Conservation Service
and
United States Department of the Interior
Bureau of Indian Affairs
In cooperation with
Montana Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1965–71. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, and the Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Sheridan County Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, or other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All of the soils of Sheridan County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information about the soils. This guide lists all of the soils of the county in alphabetic order by map symbol. It shows the page where each kind of soil is described, and also the page for the capability unit, windbreak suitability group, and range site to which the soil has been assigned.

Individual colored maps showing the relative suitability or limitations of soils for many specific purposes can be developed by using the soil map and information in the text. Interpretations not included in the text can be developed by grouping the soils according to their suitability or limitations for a particular use. Transparent material can be laid over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the interpretative groupings.

Ranchers and others interested in range can find, under "Range," groupings of the soils according to their suitability for range, and also the names of the plants that grow on each range site.

Engineers, builders, and community planners will find, under "Engineering Uses of the Soils," tables that contain information about engineering practices.

Community planners and others concerned with recreational development can learn, in the section "Recreation," about soil properties that affect the choice of sites for selected recreational uses.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of the Soils."

Students, teachers, and others will find information about soils and their management in various parts of the text.

Newcomers in Sheridan County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Information About the County," which gives information about the history, landscape, climate, and natural resources of the county.

Cover: Stripcropping on Williams loam, undulating.

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SOIL SURVEY OF SHERIDAN COUNTY, MONTANA

BY ROBERT E. RICHARDSON AND LAURENCE T. HANSON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, IN COOPERATION WITH THE MONTANA AGRICULTURAL EXPERIMENT STATION

SHERIDAN COUNTY is in the extreme northeast corner of Montana (fig. 1). It has a total area of 1,700 square miles, or 1,088,000 acres. Plentywood, in the center of Sheridan County, is the county seat.

Elevation ranges from 1,933 to 2,600 feet above sea level. The mean annual air temperature is 40° to 45° F, and the frost-free period is 110 to 125 days. The annual precipitation ranges from 12 to 15 inches.

Most of the county is uplands, and relief is undulating to strongly sloping. Areas of bottom lands are mainly along Big Muddy Creek and its major tributaries. Most of these areas are subject to flooding. Terraces along Big Muddy Creek and its major tributaries are nearly level and gently sloping. In many places steep escarpments separate the terraces and uplands from the bottom lands.

Slightly more than half of the acreage in the county is used for small grain. Most of the rest is used for range. Livestock and small grain are the major sources of farm income.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Sheridan County, where they are located, and how they can be used. They went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes; the size of streams; the kinds of native plants or crops; the kinds of rock; and various facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by plant roots.

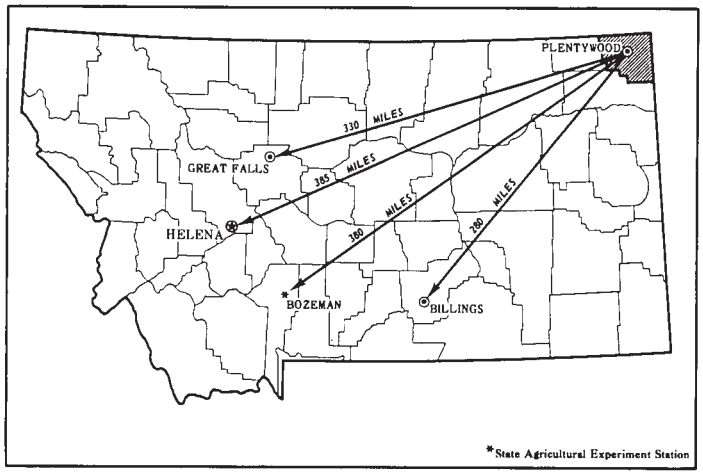

Figure 1.—Location of Sheridan County in Montana.

The soil scientists made comparisons among the profiles they studied, and compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in this survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Williams and Zahill, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many soil series contain soils that are similar except for texture of the surface layer, range of slope, degree of erosion, number and size of stones, or some other feature affecting their use enough that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soils are divided into soil phases. The name of the soil phase indicates a feature that affects management. For example, Savage silty clay loam, 0 to 2 percent slopes, is one of several phases of the Savage series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew soil boundaries on aerial photographs. They used photographs for their base map because they show buildings, field borders, trees, and similar details that help in drawing boundaries accurately. The soil map in the back of this survey was prepared from aerial photographs.

A mapping unit consists of all those areas shown on a soil map that are identified by a common symbol. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such

a map all the small, scattered bits of soil of some other kind that have been found within an area that is dominantly of a recognized soil phase.

In preparing some detailed maps, the soil scientist has a problem of delineating areas where different kinds of soil are so intricately associated and so small in size that it is not practical to show them separately on the map. Therefore, he shows this mixture of soils as one mapping unit and calls it a soil complex. Ordinarily, a soil complex is named for the major soil series in it, for example, the Lambert-Zahill complex.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined management practices are assembled from farm records and from field and plot experiments on the same kinds of soil. Yields under defined management practices are then estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way that it is readily useful to different groups of readers, among them farmers, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used. The soil scientists set up trial groups based on crop yields and other data. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others; then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Sheridan County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to those who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, drainage, or other characteristics that affect management.

The soil associations in this survey have been grouped into seven general kinds of landscape for broad interpretative purposes. Each of the broad groups and their included soil associations are described in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 2, the words "loams and clay loams" refer to the texture of the surface layer. The soils are 60 inches or more deep.

Nearly Level to Hilly, Well-Drained and Very Poorly Drained Soils on Uplands

The soils in this group of soil associations formed in glacial till and glaciolacustrine material. They are used mainly for dryland crops and as range. The average annual precipitation ranges from 10 to 14 inches, and the frost-free period is 110 to 125 days.

1. Williams association

Nearly level to gently rolling, well-drained loams; on uplands

This association consists mainly of nearly level to gently rolling soils on glacial till uplands. In a few places near large sloughs and along the few large drainageways, slopes are more than 8 percent. Slopes are short in the rolling areas.

The association makes up about 25 percent of the county. It is about 85 percent Williams soils and 15 percent less extensive soils.

Williams soils are nearly level to gently rolling. The surface layer typically is dark grayish-brown loam about 6 inches thick. The subsoil is dark grayish-brown and grayish-brown clay loam. The underlying material is grayish-brown, calcareous clay loam.

Less extensive in this association are the Bowbells, Dimmick, Farnuf, Grail, Nishon, and Zahill soils. Bowbells, Farnuf, and Grail soils are in swales and drainageways. Dimmick and Nishon soils are very poorly drained to somewhat poorly drained and are in concave basins. Zahill soils are calcareous and are on the crests of knolls and undulations.

Nearly all of this association is used for cultivated crops, but some areas are used as range. In most years crop stubble is grazed. The main enterprises are growing wheat, barley, oats, and hay and raising and feeding beef cattle, sheep, and hogs.

2. Williams-Zahill association

Undulating and gently rolling, well-drained loams and clay loams; on uplands

This association consists mostly of undulating and gently rolling soils that formed in glacial till on uplands (fig. 2). Swells and swales that have relief ranging from 4 to 25 feet are characteristic of the area. In a few places near the larger sloughs, potholes, and drainageways throughout the association, slopes are more than 8 percent.

The association makes up about 32 percent of the county. It is about 65 percent Williams soils, 30 percent Zahill soils, and 5 percent less extensive soils.

Williams soils are on the sides and bases of knolls and ridges. The surface layer is typically dark grayish-brown loam about 6 inches thick. The subsoil is dark grayish-brown and grayish-brown clay loam that is calcareous at a depth of about 16 inches. The underlying material is grayish-brown, calcareous clay loam.

Zahill soils are on the tops and crests of hills. The surface layer is typically grayish-brown, calcareous clay loam about 6 inches thick. The underlying mate-

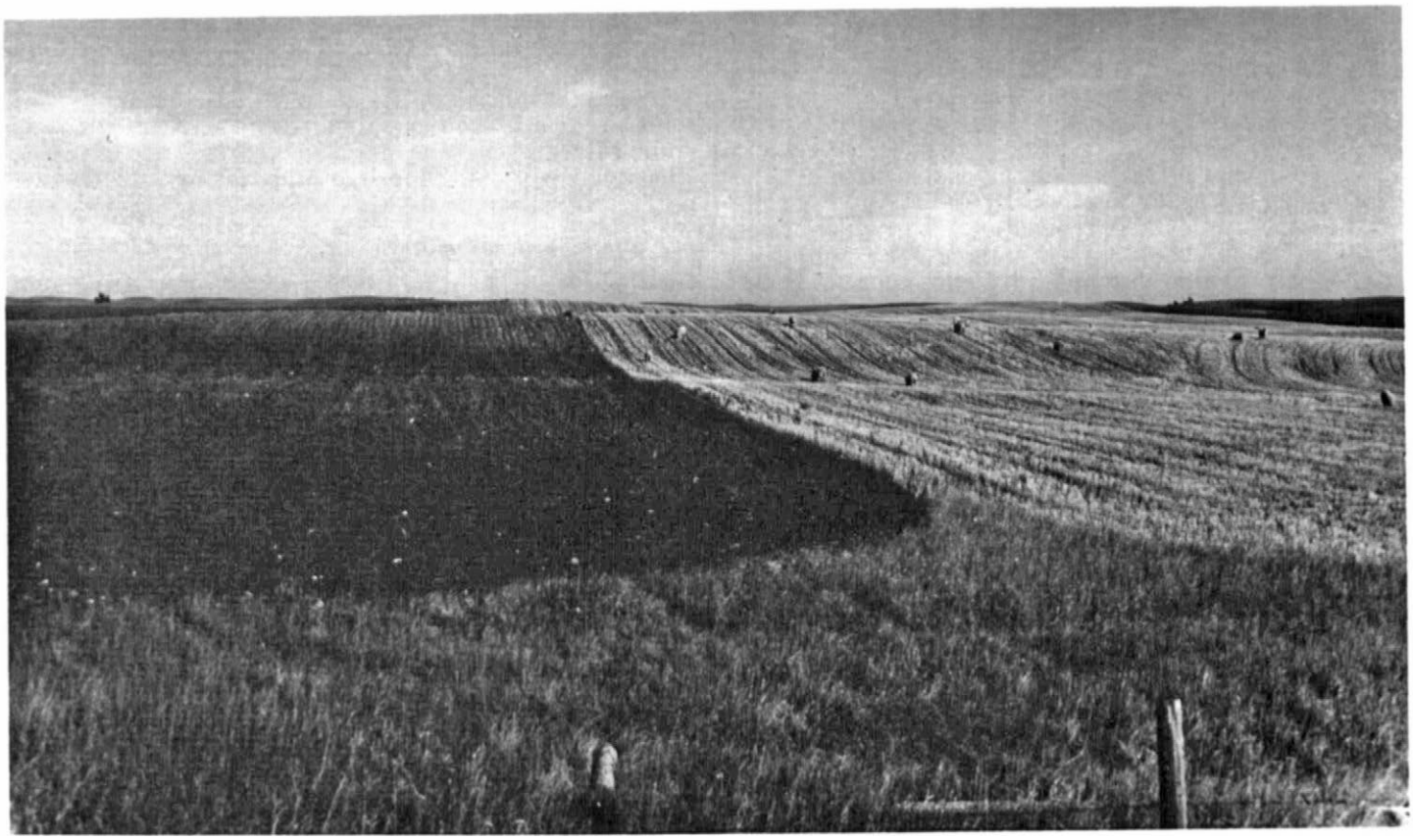

Figure 2.—Sheep grazing wheat stubble on undulating to gently rolling Williams-Zahill soils. The dark-colored Williams soils are in the foreground, and the light-colored, calcareous Zahill soils are in the background.

rial is light brownish-gray and olive-gray, calcareous clay loam.

Less extensive in this association are the Bowbells, Dimmick, Farnuf, Grail, and Nishon soils. The well-drained Bowbells, Farnuf, and Grail soils are in swales and drainageways. The very poorly drained Dimmick soils and somewhat poorly drained or poorly drained Nishon soils are in pothole areas.

Nearly all of this association is used for crops, but some areas are used as range. In most years the crop stubble is grazed. The main enterprises are growing wheat, barley, oats, and hay and raising and feeding beef cattle, sheep, and hogs.

3. Zahill-Williams-Dimmick association

Nearly level to hilly, well-drained and very poorly drained clay loams, loams, and silty clays; on uplands

This association consists of nearly level to hilly soils on terminal moraines that have numerous potholes and sloughs. The relief ranges from 25 to 65 feet. Slopes are short. The potholes and sloughs are nearly level, and the drainage from them is restricted. Large stones and boulders are common on the surface in some parts of the moraines.

The association makes up about 9 percent of the county. It is about 50 percent Zahill soils, 30 percent Williams soils, 15 percent Dimmick soils, and 5 percent less extensive soils.

Zahill soils are well drained and are on the rounded hills and ridges. The surface layer is typically grayish-brown, calcareous clay loam about 6 inches thick. The underlying material is light brownish-gray or olive-gray, calcareous clay loam.

Williams soils are well drained and are on the lower sides of hills. The surface layer is typically dark grayish-brown loam about 6 inches thick. The subsoil is dark grayish-brown clay loam that is calcareous at a depth of about 16 inches. The underlying material is grayish-brown, calcareous clay loam.

Dimmick soils are very poorly drained and are in or near potholes. The surface layer is typically very dark gray and dark-gray silty clay about 7 inches thick. The underlying material is very dark gray or gray clay that has distinct, olive mottles.

Less extensive in this association are the Bowbells, Grail, Nishon, and Wabek soils. The Bowbells and Grail soils are in swales and in some concave areas. The Nishon soils are in some potholes. The Wabek soils are on the ridges and knolls of gravelly outwash deposits.

Nearly all of this association is used as range, but some gently sloping areas are used intermittently for small grain. The main enterprise is raising and feeding cattle.

4. Savage-Marias association

Nearly level and gently sloping, well-drained silty clay loams and clays; on uplands

This association consists mostly of nearly level and

gently sloping soils that formed in alluvial and lacustrine material. In a few places near drainageways and in areas adjacent to the glacial till uplands, slopes are more than about 4 percent.

This association makes up about 1 percent of the county. It is about 70 percent Savage soils, 25 percent Marias soils, and 5 percent less extensive soils.

Savage soils formed in alluvium and are gently sloping. The surface layer is typically dark grayish-brown silty clay loam about 8 inches thick. The subsoil is grayish-brown silty clay and silty clay loam. It is underlain by grayish-brown, calcareous sandy clay or silty clay at a depth of about 23 inches.

Marias soils formed in lacustrine material and are nearly level. The surface layer is typically grayish-brown clay about 24 inches thick. The underlying material below a depth of 24 inches is olive-gray and grayish-brown clay.

Less extensive in this association are the Lambert and Zahill soils and Ustifluvents, saline. The Lambert and Zahill soils are calcareous and are on knolls and ridges and are intermingled with Savage soils. The Ustifluvents, saline, are in the beds of dry salt lakes and in some saline seep areas.

Nearly all of this association is used for crops, but a few areas are used as range. The main enterprises are growing wheat, barley, oats, and hay and raising and feeding beef cattle.

Nearly Level to Steep, Well-Drained to Excessively Drained Soils Mainly on Upland Plains

The soils in this group of associations formed in material deposited by wind and water. They are used mainly for dryland crops and range and as wildlife habitat. The average annual precipitation ranges from 10 to 14 inches, and the frost-free period is 110 to 125 days.

5. Dooley-Parshall association

Nearly level to gently rolling, well-drained fine sandy loams; on uplands

This association consists of nearly level to gently rolling fine sandy loams that formed in glacial till. In a few places along the large drainageways, slopes are more than about 8 percent.

The association makes up about 3 percent of the county. It is about 75 percent Dooley soils, 20 percent Parshall soils, and 5 percent less extensive soils.

Dooley soils are nearly level to gently rolling. The surface layer is typically dark grayish-brown fine sandy loam about 7 inches thick. The subsoil is brown sandy clay loam. Contrasting underlying material of grayish-brown, calcareous clay loam is at a depth of about 20 to 40 inches.

Parshall soils are gently rolling. The surface layer is typically dark grayish-brown fine sandy loam about 7 inches thick. The subsoil is dark grayish-brown fine sandy loam in the upper part and grayish-brown, calcareous sandy loam in the lower part. The underlying material is grayish-brown, calcareous coarse sandy loam.

Less extensive in this association are the Dimmick, Williams, and Zahill soils. The very poorly drained Dimmick soils are in undrained basins. The Williams soils are in nearly level areas. The Zahill soils are along drainageways and in exposed areas of glacial till on knolls.

Nearly all of this association is used for crops, but some areas are used as range. In most years the crop stubble is grazed. The main enterprises are growing wheat, barley, oats, and hay and raising and feeding beef cattle, sheep, and hogs.

6. Blanchard association

Gently rolling to hilly, well-drained fine sands and loamy sands; on uplands

This association consists of gently rolling to hilly soils that formed in material deposited by wind on uplands. It has a dune topography. The relief is 25 to 50 feet between hilltops and swale bottoms.

This association makes up about 3 percent of the county. It is about 95 percent Blanchard soils and 5 percent less extensive soils.

Blanchard soils have a surface layer of grayish-brown fine sand or loamy sand about 3 inches thick. The underlying material is light brownish-gray and pale-brown fine sand.

Less extensive in this association are the Lihen and Zahill soils. Lihen soils are in swales and in nearly level areas. Zahill soils are on exposed hills and knolls of glacial till uplands.

Nearly all of this association is used as range and as wildlife habitat. The main enterprise is raising and feeding beef cattle.

7. Lihen-Parshall association

Nearly level to gently rolling, well-drained loamy fine sands and fine sandy loams; on uplands

This association consists of nearly level to gently rolling soils that formed in deep sands that mantle glacial till. In a few places along drainageways, slopes are more than about 8 percent.

The association makes up about 3 percent of the county. It is about 50 percent Lihen soils, 45 percent Parshall soils, and 5 percent less extensive soils.

Lihen soils are nearly level and undulating. The surface layer is typically dark grayish-brown loamy fine sand about 24 inches thick. The underlying material is grayish-brown, calcareous loamy fine sand in the upper part and grayish-brown, calcareous loamy sand or light sandy loam in the lower part.

Parshall soils are in swales and drainageways. The surface layer is typically dark grayish-brown fine sandy loam about 7 inches thick. The subsoil is dark grayish-brown fine sandy loam in the upper part and grayish-brown, calcareous sandy loam in the lower part. The underlying material is grayish-brown, calcareous coarse sandy loam.

Less extensive in this association are the Blanchard, Tally, and Zahill soils. Blanchard soils are on dunes. Tally soils are in undulating and gently rolling areas. Zahill soils are on exposed knolls of glacial till.

Most of the Lihen soils in this association are used as range, but some are used for improved hayland. Most of the Parshall soils are used for crops, and in most years the crop stubble is grazed. The main enterprises are growing wheat, barley, oats, and hay and raising and feeding beef cattle.

8. Manning-Wabek association

Nearly level to steep, excessively drained and somewhat excessively drained gravelly sandy loams and coarse sandy loams; on outwash plains

This association consists of nearly level to steep soils that formed in alluvium and glacial outwash.

The association makes up about 5 percent of the county. It is about 65 percent Manning soils, 30 percent Wabek soils, and 5 percent less extensive soils.

Manning soils are somewhat excessively drained and are nearly level to moderately sloping. The surface layer is typically dark grayish-brown coarse sandy loam about 8 inches thick. The subsoil is grayish-brown coarse sandy loam that is calcareous in the lower part. The underlying material is loose very gravelly sand.

Wabek soils are excessively drained and are on the gravelly mounds in the hilly and steep areas along drainageways and around ponds. The surface layer is typically dark grayish-brown gravelly sandy loam about 9 inches thick. The underlying material is light brownish-gray and is calcareous. It is very gravelly sandy loam in the upper 5 inches and loose very gravelly sand below.

Less extensive in this association are the Parshall, Tally, and Turner soils. Parshall soils are in swales. Tally and Turner soils are in nearly level and undulating areas.

Manning soils are used for dryland wheat, barley, oats, and tame hayland and as range. Wabek soils are mostly used as range, but a few small areas are used for crops. Some of the soils are used as nesting areas by birds because of the proximity of water in ponds and in Medicine Lake. The main enterprises are growing wheat, barley, and oats and raising and feeding beef cattle. Both soils are a source of sand and gravel.

Nearly Level to Gently Rolling, Well-Drained Soils on Uplands and Stream Terraces

The soils in this association formed in alluvium. They are used mainly for dryland crops and hay. A few areas are in range. The average annual precipitation ranges from 10 to 14 inches, and the frost-free period is 110 to 125 days.

9. Turner-Farnuf association

Nearly level to gently rolling, well-drained loams; on uplands and stream terraces

This association consists of nearly level soils on terraces and gently rolling soils on terrace edges along Big Muddy Creek and its larger tributaries. In a few places along the terrace edges, slopes are more than about 8 percent.

The association makes up about 4 percent of the county. It is about 60 percent Turner soils, 35 percent Farnuf soils, and 5 percent Bowbells, Williams, and Wabek soils.

Turner soils are nearly level to gently rolling. The surface layer is typically dark grayish-brown loam about 7 inches thick. The subsoil is grayish-brown clay loam that is calcareous in the lower part. The underlying material, at a depth of about 26 to 40 inches, is very gravelly sand.

Farnuf soils are nearly level and are in swales. The surface layer is typically dark grayish-brown loam about 7 inches thick. The subsoil is grayish-brown clay loam. The underlying material is grayish-brown, calcareous clay loam.

Less extensive in this association are the Bowbells, Wabek, and Williams soils. Bowbells soils are in drainageways and swales. Wabek soils are on gravelly knolls and along the steep sides of drainageways. Williams soils are nearly level and undulating and are in areas of glacial till.

Nearly all of this association is used for crops and hay, but a few areas are used as range. The main enterprises are growing wheat, barley, oats, and hay and raising and feeding beef cattle.

Nearly Level to Moderately Sloping, Well-Drained and Moderately Well Drained Soils on Flood Plains, Terraces, and Alluvial Fans

The soils in this group of soil associations formed in alluvium from the surrounding uplands. They are used mainly for crops and hay. Some areas are used only as range. The average annual precipitation ranges from 10 to 14 inches, and the frost-free period is 110 to 125 days.

10. Havrelon-Cherry association

Nearly level to moderately sloping, well-drained silt loams and silty clay loams; on flood plains and fans

This association consists of nearly level to moderately sloping soils that formed in alluvium on flood plains and uplands. In some places along the drainageways, slopes are more than about 8 percent.

The association makes up about 4 percent of the county. It is about 65 percent Havrelon soils, 30 percent Cherry soils, and 5 percent less extensive soils.

Havrelon soils are nearly level and are on flood plains of Big Muddy Creek and its larger tributaries. The surface layer is typically light brownish-gray, calcareous silt loam about 7 inches thick. The underlying material is grayish-brown, calcareous loam, silt loam, and silty clay loam.

Cherry soils are gently sloping and moderately sloping and are on fans. The surface layer is typically grayish-brown, calcareous silty clay loam about 6 inches thick. The subsoil is grayish-brown, calcareous silty clay loam. The underlying material is light olive-brown, calcareous silty clay loam.

Less extensive in this association are the Lambert, Lohler, Nobe, and Trembles soils. Lambert soils are on uplands. Lohler soils are on flood plains. Nobe soils are saline and are in swales on flood plains. Trembles soils are mostly along the streams.

About two-thirds of this association is used for growing wheat, barley, and oats, and about one-third is used as range and hayland. The main enterprises are raising and feeding beef cattle, sheep, and hogs.

11. Nobe-Lohler-Bowdoin association

Nearly level, moderately well drained clays and silty clays; on flood plains

This association consists of nearly level soils that formed in alluvium on the flood plain of Big Muddy Creek.

The association makes up about 2 percent of the county. It is about 45 percent Nobe soils, 30 percent Lohler soils, 20 percent Bowdoin soils, and 5 percent less extensive soils.

Nobe soils are saline and are in concave areas. The surface layer is typically grayish-brown silt loam about 1 inch thick. The subsoil is grayish-brown clay in the upper part and grayish-brown, saline silty clay in the lower part. The underlying material is grayish-brown, saline silty clay.

Lohler soils are on flood plains. The surface layer is typically gray, calcareous silty clay about 9 inches thick. The underlying material is light olive-gray and olive-gray, calcareous silty clay.

Bowdoin soils are in areas that have a low microrelief. The surface layer is typically gray clay about 4 inches thick. The underlying material is gray, olive-gray, and olive, calcareous and saline clay.

Less extensive in this association are the Havrelon, McKenzie, and Trembles soils. Havrelon and Trembles soils are in well-drained areas. McKenzie soils are in wet areas.

Nearly all of this association is used as range and for grass hay and alfalfa hay. The main enterprise is raising and feeding beef cattle.

Moderately Steep and Steep, Well-Drained Soils on Uplands

The soils in this association formed in glacial till and in other material of mixed origin. They are used mainly as range. The native vegetation is mainly moderately short grasses and short grasses. The average annual precipitation ranges from 10 to 14 inches, and the frost-free period is 110 to 125 days.

12. Lambert-Zahill association

Moderately steep and steep, well-drained silty clay loams and clay loams; on uplands

This association consists of moderately steep and steep soils that formed in glacial till and in other material of mixed origin.

The association makes up about 8 percent of the county. It is about 65 percent Lambert soils, 25 percent Zahill soils, and 10 percent less extensive soils.

Lambert soils are gently sloping and are on steep edges of uplands. The surface layer is typically grayish-brown, calcareous silty clay loam about 6 inches thick. The underlying material is light brownish-gray, calcareous silty clay loam.

Zahill soils are on the glacial-till-capped sedimentary ridges and the tops of the sidewalls that form the drainageways. The surface layer is typically grayish-brown, calcareous clay loam about 6 inches thick. The underlying material is light brownish-gray and olive-gray, calcareous clay loam.

Less extensive in this association are the Cherry and Havrelon soils. Some areas of shale outcrop are in this association. Cherry soils are gently sloping and moderately sloping and are on fans. Havrelon soils are nearly level and are along drainageways. Shale outcrops are on very steep, barren knolls, ridges, and pillars.

Nearly all of this association is used as range. Some areas of nearly level soils along drainageways are used for crops or hay. The main enterprise is raising and feeding beef cattle.

Nearly Level, Poorly Drained Soils on Lowlands

The soils in this association formed in alluvium washed from the surrounding uplands. They are used mainly as range, but some areas are harvested for native hay. The native vegetation is mainly tall, coarse grasses and some moderately short grasses and short grasses. The average annual precipitation is 10 to 14 inches, and the frost-free period is 110 to 125 days.

13. McKenzie association

Nearly level, poorly drained silty clay loams; on lowlands

This association consists of nearly level soils that formed in alluvium.

The association makes up about 0.5 percent of the county. It is about 85 percent McKenzie soils and 15 percent less extensive soils.

McKenzie soils are poorly drained. The surface layer is typically gray, alkaline silty clay loam about 8 inches thick. The underlying material is olive-gray and gray, alkaline silty clay and clay.

Less extensive in this association are the Havrelon, Lohler, Manning, Trembles, and Lihen soils. These soils are in well-drained, elevated areas throughout the county.

This association is used as range, for hay, and for wildlife habitat. Livestock is grazed during the fall in most years.

Nearly Level to Steep, Excessively Drained Soils on Steep Terraces

The soils in this association formed in glacial outwash. They are used mainly as range and as a source of sand and gravel. The vegetation is mainly moderately short grasses and short grasses. The average annual precipitation is 10 to 14 inches, and the frost-free period is 110 to 125 days.

14. Wabek association

Nearly level to steep, excessively drained gravelly sandy loams; on terrace edges and outwash plains

This association consists of nearly level to steep soils that formed in gravel and sand glacial outwash material.

The association makes up about 0.5 percent of the county. It is about 90 percent Wabek soils and 10 percent less extensive soils.

Wabek soils are on outwash plains and steep terrace edges. The surface layer is typically dark grayish-brown gravelly sandy loam, about 9 inches thick. The underlying material is light brownish-gray, calcareous very gravelly sandy loam in the upper 5 inches and loose, calcareous gravelly sand below.

Less extensive in this association are the Manning and Turner soils. Manning soils are coarse sandy loams and are in swales. Turner soils are nearly level and undulating loams.

This association is used as range and is an important source of gravel.

Descriptions of the Soils

This section describes the soil series and mapping units in Sheridan County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series is described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is detailed and in technical terms and is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section "How This Survey was Made," not all mapping units are members of a soil series. Ustifluvents, saline, for example, does not belong to a soil series but is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and windbreak suitability group in which the mapping unit has been placed. The page for the description of each capability unit, range site, windbreak suitability group, or other interpretative groups can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.[1]

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In instances where a soil series has one or more features outside the defined range, the differences are explained.

Blanchard Series

The Blanchard series consists of gently rolling to hilly, well-drained soils on uplands. These soils formed in material deposited by wind. The native vegetation is mainly prairie sandreed, sand bluestem, little bluestem, and shrubs.

In a representative profile the surface layer is grayish-brown fine sand about 3 inches thick. The underlying material, to a depth of 60 inches, is pale-brown fine sand.

[1] United States Department of Agriculture. 1951. Soil Survey Manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Blanchard fine sand, 4 to 20 percent slopes	21,887	2.0	Marias clay	2,942	.3
Blanchard loamy sand, 4 to 12 percent slopes	2,361	.2	McKenzie silty clay loam	6,881	.6
Bowbells silt loam, 0 to 2 percent slopes	3,040	.3	Nishon loam	1,025	(1)
Bowbells silt loam, 2 to 4 percent slopes	1,858	.2	Nobe clay	8,842	.8
Bowdoin clay	5,795	.5	Parshall fine sandy loam, 2 to 6 percent slopes	8,610	.8
Cherry silty clay loam, 2 to 4 percent slopes	5,775	.5	Savage silty clay loam, 0 to 2 percent slopes	2,744	.3
Cherry silty clay loam, 4 to 8 percent slopes	4,660	.4	Savage silty clay loam, 2 to 4 percent slopes	4,101	.4
Dimmick silty clay	4,385	.4	Savage silty clay loam, 4 to 8 percent slopes	1,316	.1
Dooley fine sandy loam, 0 to 6 percent slopes	27,537	2.5	Shambo loam	2,393	.2
Dooley fine sandy loam, 6 to 12 percent slopes	10.394	1.0	Tally sandy loam, 2 to 6 percent slopes	1,712	.2
Farnuf loam, 0 to 2 percent slopes	10,260	.9	Trembles fine sandy loam	2,510	.2
Farnuf loam, 2 to 4 percent slopes	16,581	1.5	Turner loam, 0 to 4 percent slopes	20,490	1.9
Farnuf loam, 4 to 8 percent slopes	1,380	.1	Turner loam, 4 to 8 percent slopes	971	(1)
Farnuf-Turner complex, 0 to 6 percent slopes	5,608	.5	Ustifluvents, saline	4,038	.4
Grail silty clay loam	2,227	.2	Wabek gravelly sandy loam, 0 to 35 percent slopes	19,604	1.8
Havrelon silt loam	22,442	2.1	Wabek-Lambert complex, 15 to 35 percent slopes	3,075	.3
Havrelon silt loam, saline	4,225	.4	Williams loam, undulating	209,277	19.2
Lambert silty clay loam, 2 to 4 percent slopes	674	(1)	Williams loam, gently rolling	20,101	1.9
Lambert silty clay loam, 4 to 8 percent slopes	3,872	.4	Williams-Zahill loams, undulating	87,936	8.1
Lambert silty clay loam, 8 to 15 percent slopes	2,452	.2	Williams-Zahill loams, gently rolling	168,316	15.5
Lambert-Shale outcrop complex, 15 to 65 percent slopes	19,637	1.9	Zahill clay loam, strongly rolling	29,149	2.7
Lambert-Zahill complex, 20 to 50 percent slopes	54,233	5.0	Zahill clay loam, steep	95,250	8.8
Lihen loamy fine sand, 0 to 6 percent slopes	10,511	1.0	Zahill-Williams complex, hilly	81,626	7.5
Lohler silty clay	3,165	.3	Water areas	29,756	2.7
Lohler silty clay, saline	4,040	.4	Total	1,088,000	100.0
Manning coarse sandy loam, 0 to 6 percent slopes	26,336	2.4			

[1] Less than 0.1 percent.

Permeability is rapid, and runoff is slow. The available water capacity is low or moderate.

Representative profile of Blanchard fine sand, 4 to 20 percent slopes, in sod, 1,320 feet east and 1,320 feet north of the southwest corner of sec. 26, T. 31 N., R. 57 E.:

A1—0 to 3 inches, grayish-brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; single grained; loose; many fine roots; mildly alkaline; clear boundary.

C—3 to 60 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; many fine roots in upper part, few very fine roots in lower part; mildly alkaline.

The soils range from noncalcareous to calcareous. The texture to a depth of 60 inches is fine sand or loamy sand. The C horizon ranges from light brownish gray to pale brown.

Blanchard soils are associated with Dooley, Lihen, Parshall, and Zahill soils.

BcD—Blanchard fine sand, 4 to 20 percent slopes. This gently rolling to hilly soil is on round, stabilized dunes. It has the profile described as representative of the series. Relief is 4 to 50 feet, and slopes are short. Areas range from 100 acres to several thousand acres.

Included with this soil in mapping are a few areas of soils that are shallower to bedrock than this soil. Also included are areas where outcrops of glacial till are on hills and ridges.

The hazard of soil blowing is high.

This soil is used for range, wildlife habitat, and recreation. Capability unit VIe–1; Sands range site; windbreak suitability group 6.

BdC—Blanchard loamy sand, 4 to 12 percent slopes. This gently rolling to strongly rolling soil is on small dunes near saline ponds and along drainageways on glacial till uplands. It has a profile similar to the one described as representative of the series, but it has a surface layer of loamy sand and is calcareous. Areas range from 5 acres to 50 acres.

The hazard of soil blowing is high.

This soil is used for small grain and range. Capability unit IVe–1; Sands range site; windbreak suitability group 6.

Bowbells Series

The Bowbells series consists of nearly level and gently sloping, well-drained soils in swales and large drainageways on uplands. These soils formed in alluvium from glacial till. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is very dark grayish-brown silt loam and loam about 15 inches thick. The subsoil, about 30 inches thick, is dark grayish-brown or grayish-brown clay loam. The underlying material is grayish-brown, calcareous clay loam.

Permeability is moderate, and runoff is medium. The available water capacity is high.

Representative profile of Bowbells silt loam, 0 to 2 percent slopes, in a cultivated field, 1,320 feet west and 660 feet south of the northeast corner of sec. 14, T. 36 N., R. 53 E.:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; strong, fine, granular structure; slightly hard, very friable, slightly plastic; many very fine and fine roots; less than 5 percent gravel; neutral; clear, smooth boundary.

A1—6 to 15 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; strong, fine, granular structure; slightly hard, very friable, slightly sticky; many, very fine, vertical and horizontal roots; many, very fine, inped tubular pores; less than 5 percent gravel; neutral; clear, smooth boundary.

B21t—15 to 20 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; coated with very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2) moist; moderate, medium, prismatic structure parting to moderate, fine, blocky; hard, very friable, sticky and plastic; many, very fine, vertical roots; many, very fine, inped pores; thin, continuous clay films on faces of peds; less than 5 percent gravel; mildly alkaline; gradual boundary.

B22t—20 to 36 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, prismatic structure parting to strong, fine, blocky; hard, friable, sticky and plastic; many, very fine, vertical roots; many, very fine, vertical pores; moderately thick, continuous clay films; less than 5 percent gravel; mildly alkaline; gradual boundary.

B23ca—36 to 45 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; many very fine roots; many, fine and very fine, vertical, inped pores; 5 percent gravel; strongly effervescent; lime in seams; mildly alkaline; gradual boundary.

The depth to lime ranges from 20 to 40 inches. The A horizon is 9 to 23 inches thick. The C horizon ranges from grayish brown to light grayish brown.

Bowbells soils are associated with Farnuf, Williams, and Zahill soils.

BoA—Bowbells silt loam, 0 to 2 percent slopes. This well-drained, nearly level soil is in broad drainageways on glacial till plains. It has the profile described as representative of the series. Areas range from 10 acres to 50 acres in size.

Included with this soil in mapping are a few areas of Bowbells soils that have a thinner surface layer than is typical for the series.

The hazard of erosion is slight.

This soil is used for crops, grass hay, and alfalfa hay. Capability unit IIIe–5; Silty range site; windbreak suitability group 1.

BoB—Bowbells silt loam, 2 to 4 percent slopes. This well-drained, gently sloping soil is in swales and narrow drainageways on glacial till plains. Areas range from 10 acres to 40 acres.

Included with this soil in mapping are a few areas of Bowbells soils that have a thinner surface layer and a thinner subsoil than are typical for the series.

The hazard of erosion is moderate.

This soil is used for small grain, grass hay, and alfalfa hay. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

Bowdoin Series

The Bowdoin series consists of nearly level, moderately well drained soils on the flood plain of Big Muddy Creek and its larger tributaries. These soils formed in alluvium. The native vegetation is mainly western wheatgrass, Sandberg bluegrass, and perennial forbs.

In a representative profile the surface layer is gray

clay about 4 inches thick. The underlying material, to a depth of 60 inches, is gray, olive-gray, and olive, calcareous and saline clay.

Permeability is very slow, and runoff is very slow. The available water capacity is high.

Representative profile of Bowdoin clay, in grass, 1,320 feet south and 150 feet east of the northeast corner of NE¼ sec. 10, T. 31 N., A. 55 E.:

Ap—0 to 4 inches, gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; strong, fine, granular structure; hard, friable, very sticky and very plastic; some surface crusting; weakly effervescent; moderately alkaline; clear boundary.

C1—4 to 17 inches, gray (5Y 5/1) clay, olive gray (5Y 4/2) moist; moderate, fine and medium, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few roots; strongly effervescent; moderately alkaline; gradual, irregular boundary.

C2cs—17 to 25 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; faint, dark yellowish-brown (10YR 3/4 and 10YR 4/4) mottles, moist; moderate, fine, subangular blocky structure; extremely hard, very firm, sticky and very plastic; seams and clusters of gypsum salts; strongly effervescent; moderately alkaline; gradual, irregular boundary.

C3cs—25 to 60 inches, olive (5Y 5/3) clay, olive gray (5Y 4/2) moist; few or common, faint, dark yellowish-brown (10YR 3/4 and 10YR 4/4) mottles, moist; massive; extremely hard, very firm, slightly sticky and very plastic; seams and nests of gypsum salts; very strongly effervescent; moderately alkaline.

The depth to mottles ranges from 17 to 25 inches. Gypsum salts are at a depth of 17 to 60 inches.

Bowdoin soils are associated with McKenzie, Lohler, and Havrelon soils.

Bw—Bowdoin clay. This nearly level, moderately well drained soil is on the flood plain of Big Muddy Creek. It has a microrelief of 3 to 12 inches. Slopes are 0 to 1 percent. Areas range from 40 to 480 acres in size.

Included with this soil in mapping are some saline soils and some wet soils around ponds or near creeks.

Flooding is frequent.

This soil is used for range and grass hay. Capability unit VIs–2; Dense Clay range site; windbreak suitability group 6.

Cherry Series

The Cherry series consists of gently sloping and moderately sloping, well-drained soils on foot slopes, fans, and terraces along the major streams. These soils formed in silty alluvium from soft silty shale. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is grayish-brown, calcareous silty clay loam about 6 inches thick. The subsoil is grayish-brown, calcareous silty clay loam about 34 inches thick. The underlying material, to a depth of 60 inches, is light olive-brown, calcareous silty clay loam.

Permeability is moderate, and runoff is medium. The available water capacity is high.

Representative profile of Cherry silty clay loam, 2 to 4 percent slopes, in a cultivated field, 100 feet west and 100 feet north of the southeast corner of NW¼ sec. 27, T. 36 N., R. 52 E.:

Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong, fine, granular structure; slightly hard, very friable, sticky and plastic; many very fine and fine roots; slightly effervescent; mildly alkaline; clear, smooth boundary.

B2—6 to 16 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; dark grayish-brown (2.5Y 4/2) coatings, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, prismatic structure parting to moderate, fine and medium, blocky; hard, friable, sticky and plastic; many very fine roots; many, very fine and fine, continuous, inped pores; strongly effervescent; moderately alkaline; gradual boundary.

B3—16 to 40 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; dark grayish-brown (2.5Y 4/2) coatings, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; common very fine roots; common, very fine, vertical, inped, continuous, tubular pores; violently effervescent; lime in fine seams in and around root channels; moderately alkaline; gradual boundary.

C—40 to 60 inches, light olive-brown (2.5Y 5/4) light silty clay loam, olive brown (2.5Y 4/4) moist; weak, coarse, prismatic structure parting to weak, fine, platy; hard, friable, sticky and plastic; few very fine roots; few fine pores; violently effervescent; common small seams of lime in upper part, disseminated lime in lower part; moderately alkaline.

The A horizon ranges from silt loam to silty clay loam and from noncalcareous to calcareous. It ranges from grayish brown to light brownish gray. The B horizon ranges from grayish brown to light brownish gray and from fine silt loam to light silty clay. The C horizon is mainly silty clay loam.

Cherry soils are associated with Farnuf, Havrelon, Lambert, and Shambo soils.

ChB—Cherry silty clay loam, 2 to 4 percent slopes. This well-drained, gently sloping soil is on slopes and fans along Big Muddy Creek and its larger tributaries. It has the profile described as representative of the series. Most areas are oblong and range from 10 to 320 acres in size.

The hazard of erosion is moderate.

This soil is used for crops and alfalfa hay and as range. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

ChC—Cherry silty clay loam, 4 to 8 percent slopes. This well-drained, moderately sloping soil is on smooth slopes along Big Muddy Creek and its larger tributaries. It has a profile similar to the one described as representative of the series, but it has a thinner surface layer and a thinner subsoil. Most areas are oblong or irregular in shape and range from 20 acres to 320 acres in size.

Included with this soil in mapping areas are some low knolls that consist of shale.

The hazard of erosion is moderate or high.

This soil is used for crops and alfalfa hay and as range. Capability unit IIIe–1; Silty range site; windbreak suitability group 1.

Dimmick Series

The Dimmick series consists of nearly level, very poorly drained soils in enclosed basins or kettles on uplands. These soils formed in alluvium. The native vegetation is mainly western wheatgrass, green needlegrass, and needle-and-thread.

In a representative profile the surface layer is very

dark gray silty clay about 7 inches thick. The underlying material, to a depth of 60 inches, is very dark gray and dark-gray, mottled, noncalcareous to calcareous clay.

Permeability is very slow, and runoff is ponded. The available water capacity is high.

Representative profile of Dimmick silty clay in cultivated field, 1,320 feet west and 100 feet south of the northeast corner of sec. 14, T. 34 N., R. 57 E.:

Ap—0 to 7 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; strong, fine, granular structure; hard, very friable, very sticky and very plastic; many very fine, fine, and medium roots; common broken snail shells; mildly alkaline; clear, smooth boundary.

C1g—7 to 18 inches, very dark gray (5Y 3/1) clay, black (5Y 2/1) moist; few, fine, distinct mottles, olive (5Y 4/3) moist; strong, fine, subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine, fine, and medium roots; many, very fine and medium, inped, vertical, tubular pores; common broken snail shells; moderately alkaline; gradual boundary.

C2g—18 to 40 inches, very dark gray (5Y 3/1) clay, black (5Y 2/1) moist; few, fine, distinct mottles, olive (5Y 4/3) moist; moderate, fine, subangular blocky structure; very hard, firm, very sticky and very plastic; many very fine, fine, and medium roots; many, fine and medium, inped, continuous pores; common broken snail shells; strongly effervescent; moderately alkaline; gradual boundary.

C3g—40 to 56 inches, dark-gray (5Y 4/1) clay, very dark gray (5Y 3/1) moist; common, medium, distinct mottles, olive (5Y 4/3) moist; massive; very hard, firm, very sticky and very plastic; common or few fine and medium roots; few, fine and medium, continuous, inped, tubular pores; few broken snail shells; few to common chips of lignite; strongly effervescent; lime disseminated; moderately alkaline; gradual boundary.

C4g—56 to 60 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; common, medium, distinct mottles, black (10YR 2/1) moist; massive; very hard, very firm, very sticky and very plastic; few roots; few pores; few, fine, broken snail shells; fine and medium crystals of gypsum in seams; strongly effervescent; moderately alkaline.

The depth to carbonates ranges from 18 to 40 inches. Mottles below the Ap horizon are faint or distinct.

Dimmick soils are associated with Grail, Nishon, Williams, and Zahill soils.

Dm—Dimmick silty clay. This very poorly drained, nearly level soil is in undrained, oval and oblong basins or "kettles" on glacial till plains. Slopes are 0 to 1 percent. Areas range from about 1 acre to 200 acres in size.

The hazard of erosion is slight. This soil is subject to occasional overflow from melting snow or summer rainstorms, and water is ponded for several weeks.

This soil is used for crops, alfalfa hay, and grass hay and as range. Capability unit IVw–1; Overflow range site; windbreak suitability group 6.

Dooley Series

The Dooley series consists of nearly level to strongly rolling, well-drained soils on uplands. These soils formed in a mantle of alluvial or eolian origin deposited over calcareous clay loam glacial till. The native vegetation is mainly little bluestem, prairie sandreed, and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 7 inches thick. The subsoil is about 17 inches thick. It is brown sandy clay loam in the upper part and calcareous, grayish-brown heavy sandy loam in the lower part. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous clay loam.

Permeability is moderate above a depth of 20 to 40 inches and moderately slow below. Runoff is slow or medium. The available water capacity is high.

Representative profile of Dooley fine sandy loam, 0 to 6 percent slopes, in cultivated field, 1,320 feet south and 75 feet west of the northeast corner of sec. 33, T. 32 N., R. 58 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable, slightly sticky and nonplastic; many very fine roots; 1 percent gravel; moderately alkaline; clear, smooth boundary.

B2t—7 to 15 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure; hard, very friable; sticky and plastic; thin, continuous clay films on faces of peds and bridges of clay between grains of sand; many very fine roots; many, very fine, tubular pores; 3 percent gravel; moderately alkaline; gradual, wavy boundary.

B3ca—15 to 24 inches, grayish-brown (2.5Y 5/2) heavy sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure; hard, very friable, nonsticky and nonplastic; many, very fine, vertical roots; many, very fine, tubular pores; 10 percent gravel; strongly effervescent; lime disseminated and in common fine masses, lime casts on undersides of gravel; moderately alkaline; clear, wavy boundary.

IIC1ca—24 to 36 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; common very fine roots; common, very fine, tubular pores; 10 percent gravel; violently effervescent; small masses of lime and lime casts on undersides of gravel; moderately alkaline; gradual, wavy boundary.

IIC2—36 to 60 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, thin, platy; hard, friable, very sticky and very plastic; few roots; few pores; 10 percent gravel and stones; violently effervescent; lime disseminated; moderately alkaline.

The Ap horizon is 7 to 14 inches thick. Depth to carbonates ranges from 13 to 26 inches. Depth to clay loam glacial till ranges from 20 to 40 inches. The B2t horizon ranges from sandy clay loam to light sandy clay that is less than 35 percent clay. The B3 horizon ranges from sandy loam to light sandy clay loam. It is usually calcareous but is noncalcareous in some profiles. The Ba horizon is not present in some profiles. The C horizon ranges from grayish brown to light olive gray.

Dooley soils are associated with Farnuf, Parshall, Tally, Williams, and Zahill soils.

DoB—Dooley fine sandy loam, 0 to 6 percent slopes. This well-drained, nearly level to gently rolling soil is on glacial till uplands. It has the profile described as representative of the series. Areas range from 20 acres to several hundred acres.

Included with this soil in mapping are areas of Dooley soils in which depth to glacial till is shallower than is described for the series. Also included are some areas of gravelly soils.

Runoff is slow. The hazard of erosion is slight or moderate, and the hazard of soil blowing is moderate.

This soil is mostly used for crops, but some areas are used for range and alfalfa hay. Capability unit IIIe–7; Sandy range site; windbreak suitability group 1.

DoC—Dooley fine sandy loam, 6 to 12 percent slopes. This well-drained, gently rolling and strongly rolling soil is on glacial till uplands. Areas range from 20 to 640 acres in size.

Included with this soil in mapping are a few areas of Dooley soils that are shallower to the clay loam glacial till than is typical for the series. Also included are areas of soils that have a surface layer of sandy clay loam and soils that have slopes steeper than 12 percent, where calcareous clay loam is exposed.

Runoff is medium. The hazard of erosion is moderate to high, and the hazard of soil blowing is high.

This soil is used for crops, alfalfa hay, and range. Capability unit IIIe–4; Sandy range site; windbreak suitability group 1.

Farnuf Series

The Farnuf series consists of nearly level to moderately sloping, well-drained soils on fans, terraces, and uplands and along large drainageways. These soils formed in alluvium. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil is grayish-brown clay loam about 11 inches thick. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous clay loam.

Permeability is moderate, and runoff is slow or medium. The available water capacity is high.

Representative profile of Farnuf loam, 0 to 2 percent slopes, in a cultivated field, 300 feet east and 1,320 feet north of the southwest corner of SE¼ sec. 5, T. 36 N., R. 55 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable, very sticky and plastic; abundant roots; moderately akaline; abrupt boundary.

B2t—7 to 13 inches, grayish-brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, fine and medium, subangular blocky; hard, friable, very sticky and very plastic; moderately thick, continuous clay skins on faces of peds; moderately alkaline; gradual boundary.

B3—13 to 18 inches, grayish-brown (10YR 5/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, very sticky and very plastic; patchy clay skins on horizontal faces of peds and continuous clay skins on vertical faces of peds; moderately alkaline; gradual boundary.

C1ca—18 to 26 inches, grayish-brown (10YR 5/2) heavy clay loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure; hard, friable, very sticky and very plastic; violently effervescent; soft masses of segregated lime; moderately alkaline; clear boundary.

C2—26 to 60 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, very sticky and plastic; violently effervescent; streaks of soft lime; moderately alkaline.

The depth to lime accumulation ranges from 12 to 20 inches. The B horizon ranges from clay loam to light silty clay loam. The C horizon ranges from clay loam to light silty clay loam.

Farnuf soils are associated with Bowbells, Turner, Williams, and Zahill soils.

FaA—Farnuf loam, 0 to 2 percent slopes. This well-drained, nearly level soil is on fans and terraces and outwash areas on glacial till uplands. It has the profile described as representative of the series. Areas range from 20 acres to more than 640 acres in size.

Included with this soil in mapping are a few small areas of Farnuf soils that have a thicker surface layer than is typical for the series.

Runoff is slow. The hazard of erosion is slight. The hazard of soil blowing is slight.

This soil is mainly used for crops, grass hay, and alfalfa hay, but a few areas are used for range. Capability unit IIIe–5; Silty range site; windbreak suitability group 1.

FaB—Farnuf loam, 2 to 4 percent slopes. This well-drained, gently sloping soil is on fans, terraces, and outwash plains adjacent to large drainageways. Areas range from 20 to 160 acres in size.

Included with this soil in mapping are areas of soils that have a surface layer of gravelly loam or silty clay loam.

Runoff is slow or medium. The hazard of erosion is slight or moderate.

This soil is used mainly for crops, grass hay, and alfalfa hay, but a few areas are used for range. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

FaC—Farnuf loam, 4 to 8 percent slopes. This well-drained, moderately sloping soil is on fans and slopes along larger drainageways. Most areas are less than 100 acres in size.

Included with this soil in mapping are a few small areas of Farnuf soils that have a surface layer of gravelly loam, clay loam, or silty clay loam, and in places the subsoil is thinner than is typical for the series.

Runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for range, but some areas are used for crops and alfalfa hay. Capability unit IIIe–2; Silty range site; windbreak suitability group 1.

FtB—Farnuf-Turner complex, 0 to 6 percent slopes. This complex consists of soils in valleys that are cut by meandering stream channels. It is about 50 percent Farnuf loam, 45 percent Turner loam, and 5 percent silt loam, fine sandy loam, silty clay loam, and gravelly soils. Areas range from 50 to 150 acres in size.

The Farnuf and Turner soils have profiles similar to those described as representative of their respective series, but in places the Farnuf soil is shallower to lime, and in places the Turner soil is shallower to sand and gravel.

Runoff is medium. The soils in this complex are subject to flooding during the season of use about once in 2 years. The hazard of erosion is moderate.

The soils in this complex are used mainly for range, but some areas are used for crops and alfalfa hay. Capability unit IVe–2; Silty range site; windbreak suitability group 1.

Grail Series

The Grail series consists of nearly level, well-drained soils in swales and large drainageways on uplands. These soils formed in local alluvium mainly from soft sedimentary rock. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 16 inches thick. The subsoil is about 32 inches thick. It is very dark grayish-brown silty clay. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous clay loam.

Permeability is moderately slow, and runoff is slow. The available water capacity is high.

Representative profile of Grail silty clay loam (0 to 2 percent slopes) in a cultivated field, 1,000 feet east and 700 feet north of the southwest corner of SE¼ sec. 6, T. 35 N., R. 57 E.:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; strong, fine, granular structure; slightly hard, very friable, very sticky and plastic; many very fine and medium roots; moderately alkaline; clear, smooth boundary.

A1—10 to 16 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; strong, fine, granular structure; hard, very friable, very sticky and plastic; many very fine and fine roots; moderately alkaline; clear boundary.

B21—16 to 22 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky structure; very hard, very firm, very sticky and plastic; many, very fine and fine, continuous roots; many, very fine, continuous, inped pores; moderately alkaline; gradual boundary.

B22t—22 to 40 inches, very dark grayish-brown (10YR 3/2) heavy silty clay, very dark brown (10YR 2/2) moist; moderate, fine and medium, subangular blocky structure; very hard, very firm, very sticky and plastic; clay films on all peds; many very fine and fine roots; many, fine and very fine, continuous, inped pores; moderately alkaline; gradual boundary.

B23—40 to 48 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; weak, coarse, prismatic structure; very hard, very firm, very sticky and plastic; common, very fine roots; common, fine, inped pores; moderately alkaline; clear boundary.

IICca—48 to 60 inches, grayish-brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky and plastic; few roots; few pores; strongly effervescent; moderately alkaline.

The depth to lime ranges from 26 to more than 40 inches. The B horizon is silty clay or clay. The C horizon is clay loam or silty clay and is stratified in some profiles. Both the B and C horizons range from grayish brown to light olive gray.

Grail soils are associated with Bowbells, Dimmick, Farnuf, Williams, and Zahill soils.

Gr—Grail silty clay loam (0 to 2 percent slopes). This well-drained, nearly level soil is in swales and at the mouth of larger drainageways on the glacial till plain. Areas are less than 100 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of silt loam or silty clay. Also included in some places are soils that have a surface layer that is thinner than that of this soil.

The hazard of erosion is slight.

This soil is used mainly for crops, but some areas are used for grass hay, alfalfa hay, and as range. Capability unit IIIe–5; Silty range site; windbreak suitability group 1.

Havrelon Series

The Havrelon series consists of nearly level, well-drained soils on the flood plain of Big Muddy Creek and its larger tributaries. These soils formed in calcareous alluvium. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is light brownish-gray, calcareous silt loam about 7 inches thick. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous loam, silt loam, and silty clay loam.

Permeability is moderate, and runoff is slow. The available water capacity is high. The hazard of erosion is slight.

Representative profile of Havrelon silt loam (0 to 2 percent slopes) in a cultivated field, 2,000 feet south and 250 feet east of the northwest corner of sec. 16, T. 35 N., R. 53 E.:

Ap—0 to 7 inches, light brownish-gray (2.5Y 6/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, granular structure; slightly hard, very friable, sticky and slightly plastic; many very fine and fine roots; slightly effervescent; lime disseminated; moderately alkaline; clear boundary.

C1—7 to 22 inches, grayish-brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate, fine, platy structure; hard, very friable, sticky and slightly plastic; many very fine and fine roots; many, very fine and fine, continuous, inped pores; strongly effervescent; moderately alkaline; clear boundary.

C2—22 to 30 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, very thin, platy structure; hard, very friable, very sticky and plastic; many very fine roots; many, very fine, continuous, inped pores; strongly effervescent; moderately alkaline; clear boundary.

C3—30 to 50 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate, very thin, platy structure; hard, very friable, sticky and plastic; many very fine roots in upper part and common very fine roots in lower part; common, very fine, continuous, inped pores; few, very fine masses of salt; strongly effervescent; strongly alkaline; clear boundary.

C4—50 to 60 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; few yellowish-brown (10YR 5/4) mottles; moderate, very fine, blocky structure; very hard, firm, sticky and very plastic; few roots; few pores; strongly effervescent; moderately alkaline.

The profile ranges from nonsaline to saline.

Havrelon soils are associated with Bowdoin, Lohler, Nobe, and Trembles soils.

Ha—Havrelon silt loam (0 to 2 percent slopes). This well-drained, nearly level soil is on the flood plains of Big Muddy Creek and its larger tributaries. It has the profile described as representative of the series. Areas range from 20 acres to several hundred acres.

Included with this soil in mapping are small areas of soils that have a surface layer of fine sandy loam or silty clay loam.

The hazard of erosion is slight. Localized areas are subject to flooding.

This soil is used for crops, alfalfa hay, and range.

Areas adjacent to stream channels provide wildlife habitat. Capability unit IIIe–5; Silty range site; windbreak suitability group 1.

Hb—Havrelon silt loam, saline (0 to 2 percent slopes). This soil is on the flood plains of Big Muddy Creek and its larger tributaries in areas where drainage is restricted. It has a profile similar to the one described as representative of the series, but the content of salt is greater. Areas range from 20 to 600 acres in size.

Included with this soil in mapping are small areas of soils that have a surface layer of silty clay loam or silty clay. Also included are small areas of soils that have a water table at a depth below 40 inches.

The hazard of erosion is slight. Localized areas are subject to flooding. Because of its low position on the landscape, this Havrelon soil remains wet for longer periods during most years than is typical for the series.

This soil is used mainly for alfalfa hay or for range, but some areas are used for crops. Capability unit IIIs–1; Silty range site; windbreak suitability group 5.

Lambert Series

The Lambert series consists of calcareous, gently sloping to very steep, well-drained soils on steep edges of uplands along Big Muddy Creek and its larger tributaries. These soils formed in material of mixed origin. The vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is grayish-brown, calcareous silty clay loam about 6 inches thick. The underlying material, to a depth of 60 inches, is light brownish-gray, calcareous silty clay loam.

Permeability is moderately slow, and runoff is medium to rapid. The available water capacity is high.

Representative profile of Lambert silty clay loam, 4 to 8 percent slopes, in native sod, 1,600 feet east and 660 feet north of the southwest corner of sec. 24, T. 35 N., R. 52 E.:

A1—0 to 6 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, fine, granular structure; slightly hard, very friable, very sticky and plastic; many very fine roots; violently effervescent; moderately alkaline; clear boundary.

C1—6 to 30 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak, medium, prismatic structure; hard, friable, very sticky and very plastic; many very fine roots; violently effervescent; moderately alkaline; gradual boundary.

C2—30 to 40 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; hard, friable, very sticky and very plastic; few roots; few pores; violently effervescent; strongly alkaline; gradual boundary.

C3—40 to 60 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, very sticky and very plastic; thin seams of gypsum; multicolored, soft fragments of shale; violently effervescent; strongly alkaline.

The C horizon ranges from silt loam to silty clay loam. In some places the soil below a depth of 40 inches is stratified fine sandy loam.

Lambert soils are associated with Cherry, Havrelon, Nobe, and Zahill soils.

LaB—Lambert silty clay loam, 2 to 4 percent slopes. This well-drained, calcareous, gently sloping soil is along Big Muddy Creek and its larger tributaries. It has a profile similar to the one described as representative of the series, but in some places the surface layer is silt loam or silty clay, and the underlying material is heavy silty clay loam. Areas range from 20 acres to 40 acres.

Runoff is medium. The hazard of erosion is slight.

This soil is used mainly for range, but some areas are used for crops and alfalfa hay. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

LaC—Lambert silty clay loam, 4 to 8 percent slopes. This well-drained, calcareous, moderately sloping soil is on uplands along Big Muddy Creek and its larger tributaries. It has the profile described as representative of the series. Areas are as much as 300 acres in size.

Included with this soil in mapping are a few areas of Lambert soils that are shallower to shale than is typical for the series and that have a surface layer of silt loam or silty clay.

Runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for range, but some areas are used for crops and alfalfa hay. Capability unit IIIe–2; Silty range site; windbreak suitability group 1.

LaD—Lambert silty clay loam, 8 to 15 percent slopes. This well-drained, calcareous, strongly sloping soil is on uplands along Big Muddy Creek and its larger tributaries. Areas range from 50 acres to 300 acres in size.

Included with this soil in mapping are a few areas of shale outcrop and a few areas of fine sand.

Runoff is rapid. The hazard of erosion is moderate to high.

This soil is used mainly for range, but some areas are used for crops. Capability unit IVe–1; Silty range site; windbreak suitability group 1.

LbF—Lambert-Shale outcrop complex, 15 to 65 percent slopes. This complex consists of moderately steep to very steep soils in rough, broken areas along Big Muddy Creek and its larger tributaries. It is about 50 percent Lambert silty clay loam and 50 percent Shale outcrop. The Shale outcrop is barren. Areas range from 100 acres to 1,000 acres in size.

The Lambert soil has a profile similar to the one described as representative of the Lambert series, but the surface layer is silt loam or sandy clay loam in places.

Runoff is rapid. The hazard of erosion is high.

All of this unit is used for range, wildlife habitat, and recreation. Capability unit VIIe–1; Thin Breaks range site; windbreak suitability group 6.

LcF—Lambert-Zahill complex, 20 to 50 percent slopes. This complex consists of well-drained, moderately steep to very steep soils on sidewalls of large, entrenched drainageways adjacent to glacial till uplands. It is about 65 percent Lambert silty clay loam and 35 percent Zahill clay loam. The Zahill soils are mostly at the top of sidewalls and at the head of drainageways. Areas range from 50 acres to 300 acres in size.

The Lambert and Zahill soils have profiles similar to those described as representative of their respective series, but the surface layer is mainly clay loam and

silty clay loam, although it is loam or silty clay loam in some places.

Runoff is rapid. The hazard of erosion is high.

These soils are used for range, wildlife habitat, and recreation. Capability unit VIe–2; Thin Hilly range site; windbreak suitability group 6.

Lihen Series

The Lihen series consists of nearly level to gently rolling, well-drained or somewhat excessively drained soils on upland plains. These soils formed in material deposited by wind or water. The native vegetation is mainly prairie sandreed, little bluestem, and sand bluestem.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 24 inches thick. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous loamy fine sand in the upper part and grayish-brown, calcareous loamy sand or light sandy loam in the lower part.

Permeability is rapid, and runoff is very slow. The available water capacity is moderate.

Representative profile of Lihen loamy fine sand, 0 to 6 percent slopes, in native sod, 300 feet west and 400 feet north of the southeast corner of SW¼ sec. 8, T. 31 N., R. 57 E.:

A1—0 to 14 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable; many fine and very fine roots; moderately alkaline; gradual boundary.

AC—14 to 24 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; massive; hard, very friable; many fine and very fine roots; many, fine and very fine, tubular pores; moderately alkaline; gradual boundary.

C1—24 to 36 inches, grayish-brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; massive; hard, very friable; many very fine roots; slightly effervescent; moderately alkaline; gradual boundary.

C2—36 to 60 inches, grayish-brown (2.5Y 5/2) loamy sand or light sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable; strongly effervescent; moderately alkaline.

The C horizon ranges from slightly calcareous to strongly calcareous.

Lihen soils are associated with Blanchard, Dooley, Parshall, and Manning soils.

LhB—Lihen loamy fine sand, 0 to 6 percent slopes. This well-drained, nearly level to gently rolling soil is on uplands. Areas range from 100 to 1,000 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of sandy loam and a few areas of soils in which depth to glacial till is less than 60 inches.

The hazard of erosion is high.

Most of this soil is used for range, but a few areas are used for crops. Capability unit IVe–1; Sands range site; windbreak suitability group 3.

Lohler Series

The Lohler series consists of nearly level, moderately well drained, calcareous soils on the flood plains of Big Muddy Creek and its larger tributaries. These soils formed in calcareous clay and silty clay alluvium. The native vegetation is mainly western and thickspike wheatgrass and green needlegrass.

In a representative profile the surface layer is gray, calcareous silty clay about 9 inches thick. The underlying material, to a depth of 60 inches, is light olive-gray and olive-gray, calcareous silty clay.

Permeability is slow, and runoff is slow. The available water capacity is moderate or high.

Representative profile of Lohler silty clay (0 to 1 percent slopes) in a cultivated field, 1,320 feet south and 100 feet west of the northeast corner of NW¼ sec. 23, T. 32 N., R. 55 E.:

A1—0 to 9 inches, gray (5Y 5/1) silty clay, dark gray (5Y 4/1) moist; moderate, fine, granular structure; very hard, firm, very sticky and very plastic; many very fine and fine roots; slightly effervescent; moderately alkaline; clear boundary.

C1—9 to 20 inches, light olive-gray (5Y 6/2) silty clay, olive gray (5Y 5/2) moist; weak, fine, platy structure; very hard, firm, very sticky and very plastic; common very fine roots; common very fine pores; violently effervescent; moderately alkaline; gradual boundary.

C2—20 to 43 inches, olive-gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; weak, fine, platy structure; very hard, firm, very sticky and very plastic; common very fine roots; common very fine pores; violently effervescent; moderately alkaline; gradual boundary.

C3cs—43 to 60 inches, olive-gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; few or common gray (10YR 5/1) mottles, dark gray (5Y 4/1) moist; massive; very hard, firm, very sticky and very plastic; no roots; few pores; common fine seams of gypsum; strongly effervescent; strongly alkaline.

The C horizon is silty clay or light clay. The profile, to a depth of 60 inches, ranges from slightly calcareous to strongly calcareous and from nonsaline to saline.

Lohler soils are associated with Bowdoin, Havrelon, Trembles, and Nobe soils.

Lo—Lohler silty clay (0 to 1 percent slopes). This moderately well drained, nearly level, calcareous soil is on the flood plains of Big Muddy Creek and its larger tributaries. It has the profile described as representative of the series. Areas range from 20 acres to 640 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of silty clay loam or clay and a few areas of Lohler soils that have more clay in the underlying material than is typical for the series. Small areas of saline soils are also included.

The hazard of erosion is slight. Localized areas are subject to flooding.

This soil is used for crops, range, and alfalfa hay. Capability unit IIIs–2; Clayey range site; windbreak suitability group 1.

Lr—Lohler silty clay, saline (0 to 1 percent slopes). This nearly level, calcareous soil is on the flood plains of Big Muddy Creek and its larger tributaries in areas where drainage is restricted. It has a profile similar to the one described as representative of the series, but in some places the surface layer is silty clay loam or clay. Areas range from 20 acres to 1,000 acres.

Included with this soil in mapping are small areas of soils that have a water table below a depth of 40 inches.

The hazard of erosion is slight. Localized areas are subject to flooding.

This soil is used mainly for range, but some areas

are used for crops and alfalfa hay. Capability unit IIIs–1; Clayey range site; windbreak suitability group 5.

Manning Series

The Manning series consists of nearly level to moderately sloping, somewhat excessively drained soils on stream terraces. These soils formed in coarse sandy loam alluvium underlain by sand and gravel. The native vegetation is mainly needle-and-thread, western wheatgrass, and prairie sandreed.

In a representative profile the surface layer is dark grayish-brown coarse sandy loam about 8 inches thick. The subsoil is about 16 inches thick. It is grayish-brown coarse sandy loam that is calcareous in the lower 6 inches. The underlying material, to a depth of 60 inches, is slightly calcareous, loose very gravelly sand.

Permeability is moderately rapid above the sand and gravel and very rapid in the sand and gravel. Runoff is slow. The available water capacity is low.

Representative profile of Manning coarse sandy loam, 0 to 6 percent slopes, in a cultivated field, 1,320 feet east and 300 feet south of the northwest corner of sec. 12, T. 34 N., R. 58 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; slightly hard, very friable; many fine and very fine, vertical and horizontal roots; 5 percent gravel; mildly alkaline; clear boundary.

B2—8 to 18 inches, grayish-brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure; hard, very friable; common, very fine, vertical roots; many, very fine and fine, continuous and broken, vertical pores; 10 percent gravel; moderately alkaline; gradual boundary.

B3ca—18 to 24 inches, grayish-brown (2.5Y 4/2) coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, very friable, nonsticky and nonplastic; few very fine roots; common, very fine, continuous pores; 15 percent gravel; violently effervescent; lime on undersides of gravel and disseminated; moderately alkaline; clear, irregular boundary.

IIC—24 to 60 inches, very gravelly sand; loose; 50 percent gravel; slightly effervescent; moderately alkaline.

The depth to sand and gravel ranges from 18 to 35 inches. Manning soils are associated with Farnuf, Parshall, Turner, Wabek, Williams, and Zahill soils.

MaB—Manning coarse sandy loam, 0 to 6 percent slopes. This somewhat excessively drained, nearly level to moderately sloping soil is on terraces formed since the last glaciation. Areas are 50 acres to more than 2,000 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of gravelly loam and gravelly sandy loam. Also included are soils in which depth to loose sand and gravel is less than 24 inches.

The hazard of soil blowing is high.

This soil is used for crops and range. Capability unit IVe–1; Shallow to Gravel range site; windbreak suitability group 3.

Marias Series

The Marias series consists of gently sloping, well-drained soils on uplands. These soils formed in clay lacustrine deposits. The native vegetation is mainly western and thickspike wheatgrass and green needlegrass.

In a representative profile the surface layer is grayish-brown clay about 24 inches thick. The underlying material, to a depth of 60 inches, is olive-gray and grayish-brown clay.

Permeability is very slow, and runoff is slow to medium. The available water capacity is high.

Representative profile of Marias clay (2 to 4 percent slopes) in a cultivated field, 1,320 feet east and 250 feet north of the southwest corner of sec. 6, T. 37 N., R. 57 E.:

Ap—0 to 4 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong, fine, granular structure; slightly hard, very friable, very sticky and very plastic; common very fine roots; slightly effervescent; moderately alkaline; clear, smooth boundary.

A11—4 to 15 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong, fine, blocky structure; very hard, extremely firm, sticky and very plastic; common very fine roots; common very fine pores; few slickensides; slightly effervescent; moderately alkaline; gradual boundary.

A12—15 to 24 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong, fine, blocky structure; very hard, extremely firm, sticky and very plastic; common very fine roots; common very fine pores; common 6- to 10-inch slickensides that have intersecting surfaces about 30 degrees from horizontal; slightly effervescent; moderately alkaline; gradual boundary.

C1cs—24 to 46 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; strong, very fine, subangular blocky structure; very hard, extremely firm, sticky and very plastic; common to few very fine roots; common to few very fine pores; common slickensides in upper 12 inches; many fine seams and common medium and large masses of gypsum; slightly effervescent; moderately alkaline; gradual boundary.

C2cs—46 to 60 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, platy structure; very hard, extremely firm, sticky and very plastic; many fine seams and ¼-inch masses of gypsum; slightly effervescent; moderately alkaline.

The profile ranges from noncalcareous to weakly calcareous. Slickensides are at depths of 12 to 36 inches. The C horizon ranges from grayish brown to light olive gray.

Marias soils are associated with Dimmick, Lambert, Savage, Williams, and Zahill soils.

Mr—Marias clay (2 to 4 percent slopes). This well-drained, gently sloping soil is on uplands. Areas range from 40 acres to 60 acres.

Included with this soil in mapping are a few areas of saline soils and a few areas of soils that have a surface layer of silty clay loam or silty clay.

The hazard of erosion is moderate.

This soil is used mainly for crops and grass hay, but some areas are used for range. Capability unit IIIs–2; Clayey range site; windbreak suitability group 1.

McKenzie Series

The McKenzie series consists of nearly level, poorly drained soils on bottom lands in broad valleys. These soils formed dominantly in clay alluvium from the nearby uplands. The native vegetation is mainly

switchgrass, prairie cordgrass, and northern reedgrass.

In a representative profile about 1 inch of very dark gray, partly decayed roots and stems overlies a surface layer of gray, strongly alkaline silty clay loam about 8 inches thick. The underlying material, to a depth of 60 inches, is olive-gray and gray, alkaline silty clay and clay.

Permeability is very slow, and runoff is ponded. The available water capacity is high.

Representative profile of McKenzie silty clay loam (0 to 2 percent slopes) in native sod, 1,320 feet west and 1,700 feet south of the northeast corner of sec. 35, T. 35 N., R. 58 E.:

O—1 inch to 0, very dark gray (5Y 3/1) moist; roots and stems.

A1g—0 to 8 inches, gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; many gray (5Y 5/1) mottles moist; black (5Y 2/1) organic stains moist; moderate, fine, granular structure; hard, very friable, sticky and plastic; many roots; many small snail shells; strongly alkaline; gradual boundary.

C1g—8 to 20 inches, olive-gray (5Y 5/2) silty clay, dark gray (5Y 4/1) moist; distinct, gray (5Y 5/1) mottles moist; weak, medium, subangular blocky structure; hard, very friable, sticky and plastic; common roots; many small snail shells; strongly alkaline; gradual boundary.

C2g—20 to 30 inches, gray (5Y 6/1) clay, gray (5Y 5/1) moist; distinct olive (5Y 5/4) mottles moist; massive; very hard, very firm, sticky and plastic; few roots; few small snail shells; mildly alkaline; clear, abrupt boundary.

C3g—30 to 46 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 5/2) moist; massive; very hard, friable, nonsticky and nonplastic; moderately alkaline; gradual boundary.

C4g—46 to 60 inches, gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; very dark gray (5Y 3/1) organic stains moist; massive; very hard, friable, nonsticky and nonplastic; stratified with thin layers of coarse sand or fine gravel; strongly alkaline.

The depth to the seasonal high water table is 36 to 48 inches. The O horizon is 1 to 4 inches thick. The A1g horizon ranges from loam to silty clay loam, but in some places it is sandy loam. Snail shells range from few to many and are mostly in the upper 20 inches of the soil.

McKenzie soils are associated with Dimmick, Havrelon, Lohler, Manning, Wabek, and Williams soils.

Mz—McKenzie silty clay loam (0 to 2 percent slopes). This poorly drained, nearly level soil is on lowlands that have a high water table and numerous areas of open water. Areas range from 20 to 600 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of clay loam, silty clay, or clay.

The hazard of erosion is none or slight. Localized areas are subject to flooding.

This soil is used for range, grass hay, and wildlife habitat. Capability unit VIw–1; Subirrigated range site; windbreak suitability group 4.

Nishon Series

The Nishon series consists of nearly level, somewhat poorly drained or poorly drained soils in undrained swales or basins on uplands. These soils formed in alluvium from the surrounding uplands. The native vegetation is mainly western wheatgrass, green needlegrass, and needle-and-thread.

In a representative profile the surface layer is light brownish-gray loam about 8 inches thick. Below this is light gray loam about 1 inch thick. The subsoil is about 35 inches thick. It is dark-gray and dark grayish-brown clay in the upper part and light yellowish-brown silty clay loam in the lower part. The underlying material, to a depth of 60 inches, is light olive-brown, calcareous silty clay loam.

Permeability is very slow, and runoff is ponded. The available water capacity is high.

Representative profile of Nishon loam (0 to 1 percent slopes) in a cultivated field, 800 feet west and 200 feet north of the southeast corner of NE¼ sec. 21, T. 33 N., R. 56 E.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; moderately alkaline; clear boundary.

A2—8 to 9 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; moderate, fine, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many, very fine, simple pores; moderately alkaline; abrupt boundary.

B21t—9 to 17 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, columnar structure parting to very fine and fine, blocky; light-gray coatings on tops of columns; very hard, very firm, very sticky and very plastic; many very fine roots; many, very fine, continuous pores; moderately alkaline; gradual boundary.

B22t—17 to 21 inches, dark grayish-brown (2.5Y 4/2) clay, dark grayish brown (2.5Y 4/2) moist; many, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine and medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; common, very fine, continuous pores; moderately alkaline; gradual boundary.

B31—21 to 30 inches, dark grayish-brown (2.5Y 4/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common, fine, faint, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles, moist; weak, coarse, prismatic structure; hard, friable, very sticky and very plastic; common microroots; common micropores; moderately alkaline; gradual boundary.

B32—30 to 44 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; common, fine, faint, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles, moist; weak, coarse, prismatic structure; hard, friable, very sticky and very plastic; common microroots; common, continuous, inped micropores; moderately alkaline; gradual boundary.

Ccacs—44 to 60 inches, light olive-brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; common, fine, faint, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles, moist; weak, medium and coarse, platy structure; hard, friable, very sticky and very plastic; few microroots; few gravel; few to common fine seams of gypsum; very strongly effervescent; lime in seams; strongly alkaline.

The depth to lime ranges from 16 to more than 40 inches. The C horizon ranges from light olive brown to light brownish gray and is moderately alkaline or strongly alkaline. In about 3 out of 5 years water remains on the surface until the early part of the growing season.

Nishon soils are associated with Farnuf, Grail, Dimmick, Williams, and Zahill soils.

Nh—Nishon loam (0 to 1 percent slopes). This somewhat poorly drained to poorly drained, nearly level soil is in basins on uplands. Areas range from about 5 to 20 acres in size.

Included with this soil in mapping are areas of Nishon soils in which the surface layer is clay loam or clay because of mixing of the material in the surface layer with that from the subsoil during cultivation.

The hazard of erosion is slight. In places this Nishon soil is ponded during most of the growing season.

This soil is used for crops, range, alfalfa hay, and grass hay. Wildlife use ponds on this soil during early spring. Capability unit IIIw–1; Overflow range site; windbreak suitability group 6.

Nobe Series

The Nobe series consists of nearly level to moderately sloping, moderately well drained, saline soils on the flood plains and adjacent slopes of Big Muddy Creek and its tributaries and in upland drainageways. These soils formed mainly in local alluvium high in content of salt. The native vegetation is mainly alkali sacaton, western wheatgrass, and saltgrass.

In a representative profile the surface layer is grayish-brown silt loam about 1 inch thick. The subsoil is about 10 inches thick. It is grayish-brown clay in the upper part and grayish-brown silty clay in the lower part. Salt seams are common in the lower part. The underlying material, to a depth of 60 inches, is grayish-brown silty clay that has common seams of salt.

Permeability is very slow, and runoff is slow to medium. The available water capacity is high.

Representative profile of Nobe clay (0 to 6 percent slopes) in native sod, 100 feet west and 50 feet north of the southeast corner of NE¼ sec. 16, T. 35 N., R. 54 E.:

A2—0 to 1 inch, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; moderate, very thin, platy structure; slightly hard, very friable, sticky and slightly plastic; many fine and medium roots; many, fine and medium, simple pores; strongly effervescent; moderately alkaline; abrupt boundary.

B2t—1 to 4 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; grayish-brown (2.5Y 5/2) faces of peds, very dark grayish brown (2.5Y 3/2) moist; light brownish-gray (2.5Y 6/2) tops of columns, grayish brown (2.5Y 5/2) moist; moderate, fine and medium, columnar structure; extremely hard, extremely firm, very sticky and very plastic; many very fine roots; few, fine or medium, simple, inped pores; bleached fine sand on faces of peds; violently effervescent; very strongly alkaline; gradual boundary.

B3cs—4 to 11 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, very fine, subangular blocky structure; very hard, firm, very sticky and very plastic; many fine and very fine roots; many, fine and very fine, simple, tubular pores; common, bleached fine sand on faces of peds; common seams of crystalline salts; violently effervescent; very strongly alkaline; gradual boundary.

C1cs—11 to 32 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, very fine, granular structure; hard, friable, very sticky and very plastic; common or few very fine roots; common or few, very fine, simple pores; common seams of salt; violently effervescent; very strongly alkaline; clear boundary.

C2cs—32 to 54 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; common, fine, distinct, dark yellowish brown (10YR 4/4) mottles, moist; moderate, fine and medium, platy structure; hard, friable, very sticky and very plastic; few roots; few pores; violently effervescent; very strongly alkaline; clear boundary.

C3cs—54 to 60 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, fine, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; many accumulations of gypsum salt; violently effervescent; very strongly alkaline.

The A2 horizon is very fine sandy loam or silt loam. It is grayish brown or light gray. The B2t horizon is dark grayish brown or grayish brown clay or silty clay. The B3cs and Ccs horizons are grayish brown or light grayish brown.

Nobe soils are associated with Bowdoin, Cherry, Havrelon, Lambert, Lohler, and Trembles soils.

No—Nobe clay (0 to 6 percent slopes). This moderately well drained, nearly level to moderately sloping soil is on the flood plains of Big Muddy Creek and its larger tributaries and in upland drainageways.

Included with this soil in mapping are a few areas of Nobe soils that have a surface layer of loam or clay and a lower content of salt and a thinner subsoil than is typical for the series.

The hazard of erosion is slight. Localized areas are subject to flooding. The available water capacity is high.

This soil is used mainly for range. Capability unit VIs–1; Saline Lowland range site; windbreak suitability group 5.

Parshall Series

The Parshall series consists of undulating and gently rolling, well-drained soils on uplands. These soils formed in alluvium and in material deposited by wind. The native vegetation is mainly little bluestem, prairie sandreed, and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 7 inches thick. The subsoil is about 33 inches thick. It is dark grayish-brown fine sandy loam in the upper part and grayish-brown, calcareous sandy loam in the lower part. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous coarse sandy loam.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate or high.

Representative profile of Parshall fine sandy loam, 2 to 6 percent slopes, in a cultivated field, 1,050 feet east and 300 feet north of the southwest corner of sec. 35, T. 32 N., R. 57 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable; many very fine roots; moderately alkaline; clear boundary.

B2—7 to 24 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure; hard, very friable; many very fine roots; many, very fine, inped pores; moderately alkaline; gradual boundary.

B3ca—24 to 40 inches, grayish-brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, very friable; common very fine roots; common very fine pores; violently effervescent; moderately alkaline; gradual boundary.

C—40 to 60 inches, grayish-brown (2.5Y 5/2) coarse sandy loam; dark grayish brown (2.5Y 4/2) moist; mas-

sive; hard, very friable; few roots; 5 percent gravel; violently effervescent; moderately alkaline.

The depth to carbonate ranges from 24 to 36 inches.

Parshall soils are associated with Blanchard, Dooley, Lihen, Williams, and Zahill soils.

PaB—Parshall fine sandy loam, 2 to 6 percent slopes. This well-drained, undulating and gently rolling soil is on uplands. Areas range from 40 to about 1,000 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of sandy loam or loamy sand. Also included in mapping are small areas of Tally soils and areas of soils that are underlain by glacial till at a depth of 40 to 60 inches.

The hazard of erosion is high.

This soil is used mainly for crops, but some areas are used for alfalfa hay and range. Capability unit IIIe–1; Sandy range site; windbreak suitability group 2.

Savage Series

The Savage series consists of nearly level to moderately sloping, well-drained soils on uplands, fans, and terraces. These soils formed in alluvium. The native vegetation is mainly western and thickspike wheatgrass and green needlegrass.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 8 inches thick. The subsoil is about 15 inches thick. It is grayish-brown silty clay and silty clay loam. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous sandy clay and light silty clay.

Permeability is slow, and runoff is slow to medium. The available water capacity is high.

Representative profile of Savage silty clay loam, 2 to 4 percent slopes, in a cultivated field, 50 feet east and 660 feet north of the southwest corner of SE¼, sec. 12, T. 37 N., R. 56 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam or silty clay, very dark grayish brown (10YR 3/2) moist; strong, very fine and fine, granular structure; slightly hard, very friable, very sticky and very plastic; many roots; moderately alkaline; clear boundary.

B2t—8 to 18 inches, grayish-brown (10YR 5/2) silty clay, dark brown (10YR 3/3) moist; strong, fine and medium, blocky structure; very hard, very firm, very sticky and very plastic; common bleached fine sand on horizontal faces of peds; few bleached silt particles on vertical faces of peds; many roots; moderately alkaline; gradual boundary.

B3—18 to 23 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, fine, prismatic structure parting to moderate, medium, blocky; very hard, very firm, very sticky, and very plastic; few bleached silt particles on vertical faces of peds; few bleached fine sand particles on horizontal faces of peds; common roots; moderately alkaline; gradual boundary.

IIC1ca—23 to 32 inches, grayish-brown (2.5Y 5/2) sandy clay, dark grayish brown (2.5Y 4/2) moist; few faint or distinct mottles; moderate, medium, prismatic structure; very hard, very firm, slightly sticky and plastic; few bleached silt particles on vertical faces of peds; very strongly effervescent; common masses of lime; moderately alkaline; gradual boundary.

IIC2ca—32 to 60 inches, grayish-brown (2.5Y 5/2) light silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, slightly sticky and plastic; strongly effervescent; common masses of lime; moderately alkaline.

The depth to lime ranges from 16 to 24 inches. These soils range from grayish brown to olive gray. The C horizon is stratified in some profiles.

Savage soils are associated with Farnuf, Marias, Williams, and Zahill soils.

SaA—Savage silty clay loam, 0 to 2 percent slopes. This well-drained, nearly level soil is on uplands. Areas range from 20 to 640 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of clay loam or silty clay and a few areas of Savage soils that have a thicker surface layer than is typical for the series.

Runoff is slow. The hazard of erosion is slight.

This soil is used mainly for crops and alfalfa hay, but a few areas are used for range. Capability unit IIIe–5; Clayey range site; windbreak suitability group 1.

SaB—Savage silty clay loam, 2 to 4 percent slopes. This well-drained, gently sloping soil is on uplands. It has the profile described as representative of the series. Areas range from 40 to 700 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of clay loam or silty clay.

Runoff is medium. The hazard of soil blowing is slight to moderate. The hazard of erosion is moderate.

This soil is used mainly for crops and alfalfa hay, but some areas are used for range. Capability unit IIIe–6; Clayey range site; windbreak suitability group 1.

SaC—Savage silty clay loam, 4 to 8 percent slopes. This well-drained, moderately sloping soil is on uplands. Areas range from about 40 to 300 acres in size.

Included with this soil in mapping are a few areas of Savage soils that have a surface layer of clay loam and a thinner subsoil than is typical for the series.

Runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for crops and alfalfa hay, but some areas are used for range. Capability unit IIIe–2; Clayey range site; windbreak suitability group 1.

Shale Outcrop

Shale outcrop is mapped only in a complex with Lambert soils.

This land type consists of shale escarpments on uplands. Slopes range from 15 to 65 percent. Runoff is rapid, and the hazard of erosion is high. The areas are barren.

Shambo Series

The Shambo series consists of gently sloping, well-drained soils on uplands. These soils formed in alluvium and in material deposited by wind. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown loam about 5 inches thick. The subsoil is about 10 inches thick. It is dark grayish-brown silt loam in the upper part and grayish-brown silt loam

in the lower part. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous silt loam.

Permeability is moderate, and runoff is medium. The available water capacity is high.

Representative profile of Shambo loam (2 to 4 percent slopes) in range, 1,000 feet west and 300 feet south of the northeast corner of SW¼ sec. 6, T. 31 N., R. 56 E.:

A1—0 to 5 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; strong, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many roots; moderately alkaline; clear boundary.

B1—5 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; strong, fine, granular structure parting to moderate, medium, prismatic; hard, friable, slightly sticky and plastic; moderately alkaline; gradual boundary.

B2—8 to 15 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; strong, medium, prismatic structure; hard, friable, sticky and plastic; moderately alkaline; gradual, wavy boundary.

Cca—15 to 60 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure; hard, friable, sticky and slightly plastic; very strongly effervescent; gravel coated with lime; moderately alkaline.

The depth to lime ranges from 12 to 25 inches. The B horizon is loam or silt loam.

Shambo soils are associated with Cherry, Farnuf, Williams, and Zahill soils.

Sh—Shambo loam (2 to 4 percent slopes). This well-drained, gently sloping soil is on uplands. Areas range from about 40 to 400 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of silt loam and a subsoil of light clay loam. Also included in some places are Shambo soils that have a surface layer and a subsoil that are thinner than is typical for the series.

The hazard of erosion is slight or moderate.

This soil is used mainly for crops and alfalfa hay, but some areas are used for native range. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

Tally Series

The Tally series consists of undulating and gently rolling, well-drained soils on uplands. These soils formed in alluvium. The native vegetation is mainly prairie sandreed, little bluestem, and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown sandy loam about 7 inches thick. The subsoil is about 13 inches thick. It is grayish-brown sandy loam. The underlying material, to a depth of 60 inches, is light brownish gray. It is calcareous sandy loam in the upper part and calcareous light sandy loam in the lower part.

Permeability is moderately rapid, and runoff is slow. The available water capacity is moderate.

Representative profile of Tally sandy loam, 2 to 6 percent slopes, in a cultivated field, 300 feet east and 300 feet south of the northwest corner of SW¼ sec. 13, T. 37 N., R. 54 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and nonplastic; moderately alkaline; clear boundary.

B2—7 to 17 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure; hard, friable, slightly sticky; few clay bridges between sand grains; moderately alkaline; clear, gradual boundary.

B3—17 to 20 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure; hard, friable, nonsticky and nonplastic; few fine and medium pebbles; few clay bridges between sand grains; moderately alkaline; clear, wavy boundary.

C1ca—20 to 30 inches, light brownish-gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; few fine and medium pebbles that have a lime accumulation on underside; common masses of lime; moderately alkaline; clear, wavy boundary.

C2—30 to 60 inches, light brownish-gray (2.5Y 6/2) light sandy loam; massive; hard, friable, slightly sticky and nonplastic or slightly plastic; moderately alkaline.

The depth to lime ranges from 12 to 20 inches. The C horizon below a depth of 30 inches ranges from sandy loam to sand.

Tally soils are associated with Dooley, Farnuf, Lihen, Parshall, and Williams soils.

TaB—Tally sandy loam, 2 to 6 percent slopes. This well-drained, undulating and gently rolling soil is on uplands. Areas range from 50 to 160 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of sandy clay loam or loam and a subsoil of light sandy clay loam.

The hazard of erosion is high.

This soil is used mainly for crops and alfalfa hay, but some areas are used for range. Capability unit IIIe–3; Sandy range site; windbreak suitability group 2.

Trembles Series

The Trembles series consists of nearly level, well-drained soils on flood plains and low terraces along the larger drainageways. These soils formed in stratified alluvium from the surrounding uplands. The native vegetation is mainly little bluestem, prairie sandreed, and needle-and-thread.

In a representative profile the surface layer is grayish-brown fine sandy loam about 5 inches thick. The underlying material, to a depth of 60 inches, is light brownish-gray and grayish-brown, stratified, calcareous fine sandy loam.

Permeability is moderately rapid, and runoff is slow. The available water capacity is high.

Representative profile of Trembles fine sandy loam (0 to 2 percent slopes) in grass, 50 feet south and 50 feet west of the northeast corner of SE¼ sec. 26, T. 32 N., R. 58 E.:

A1—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; hard, very friable; many very fine and fine roots; many very fine pores; moderately alkaline; clear, wavy boundary.

C1—5 to 40 inches, light brownish-gray (2.5Y 6/2), stratified fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, very friable; many very fine roots in upper part, common very fine roots in lower part; many, very fine, inped pores; strongly

effervescent; moderately alkaline; gradual boundary.

C2—40 to 60 inches, grayish-brown (2.5Y 5/2), stratified fine sandy loam; dark grayish brown (2.5Y 4/2) moist; few faint mottles; massive; hard, very friable; few very fine roots; few or common pores; strongly effervescent; strongly alkaline.

The A horizon ranges from calcareous to noncalcareous and is grayish brown or light brownish gray. The C horizon is stratified with lenses ranging from loamy sand to loam. It ranges from grayish brown to light olive gray.

Trembles soils are associated with Dooley, Havrelon, McKenzie, Nobe, and Parshall soils.

Tr—Trembles fine sandy loam (0 to 2 percent slopes). This well-drained, nearly level, calcareous soil is on lowlands along large valleys. Areas range from 20 to 200 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of loam or silty clay loam. Also included are some areas of saline soils.

The hazard of erosion is high. Localized areas are subject to flooding.

This soil is used mainly for range, but some areas are used for crops and alfalfa hay. Capability unit IIIe–3; Sandy range site; windbreak suitability group 2.

Turner Series

The Turner series consists of nearly level to gently rolling, well-drained soils on terraces and glacial outwash plains. These soils formed in alluvium. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil is about 19 inches thick. It is grayish-brown clay loam in the upper part and grayish-brown, calcareous light clay loam in the lower part. The underlying material, to a depth of 60 inches, is loose very gravelly sand.

Permeability is moderate above the gravelly sand and moderately rapid in the gravelly sand. Runoff is slow or medium. The available water capacity is moderate or low. The hazard of erosion is slight or moderate.

Representative profile of Turner loam, 0 to 4 percent slopes, in a cultivated field, 200 feet east and 150 feet north of the southwest corner of SE¼ sec. 16, T. 35 N., R. 53 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; hard, very friable, slightly sticky and slightly plastic; many roots; 5 percent gravel; moderately alkaline; clear boundary.

B2t—7 to 13 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; moderately thick, continuous clay films on faces of peds; many very fine roots; many, very fine, simple pores; 10 percent gravel; moderately alkaline; clear boundary.

B3ca—13 to 26 inches, grayish-brown (2.5Y 5/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many, very fine, simple pores; 10 percent gravel; violently effervescent; lime on underside of gravel; moderately alkaline; clear boundary.

IIC—26 to 60 inches, very gravelly sand; 60 percent gravel, less than 25 percent of fragments greater than 3 inches in diameter.

The A horizon ranges from 0 to 10 percent gravel, and the B horizon ranges from 5 to 10 percent gravel.

Turner soils are associated with Farnuf, Wabek, Williams, and Zahill soils.

TuB—Turner loam, 0 to 4 percent slopes. This well-drained, nearly level and undulating soil is on terraces along Big Muddy Creek and its larger tributaries. It has the profile described as representative of the series. Areas range from 5 to 640 acres in size.

Included with this soil in mapping are a few areas of Turner soils that have a surface layer of gravelly loam and a thinner subsoil than is typical for the series. Also included are areas of soils that are less than 20 inches to loose sand and gravel.

Runoff is slow to medium. The hazard of erosion is slight or moderate.

This soil is used mainly for crops, alfalfa hay, and range. Capability unit IIIe–1; Silty range site; windbreak suitability group 2.

TuC—Turner loam, 4 to 8 percent slopes. This well-drained, gently rolling soil is on terraces and uplands. It has a profile similar to the one described as representative of the series, but the subsoil is thinner and the depth to loose sand and gravel is less than 26 inches. Areas range from 5 to 100 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of clay loam or gravelly clay loam.

Runoff is medium. The hazard of erosion is moderate.

This soil is used for crops, alfalfa hay, and range. Capability unit IIIe–1; Silty range site; windbreak suitability group 2.

Ustifluvents, Saline

Uf—Ustifluvents, saline. This land type consists of stratified, saline alluvium on nearly level flood plains and along the shorelines of saline ponds. In most areas the surface layer is clay or silty clay that is covered with a white crust of salt. The underlying layer is stratified material that ranges from loam to clay. Many areas have a water table at a depth of less than 20 inches during part of the growing season. Most areas are almost barren.

The soils of this land type are used for range and wildlife habitat. Capability unit VIIw–4; Saline Lowland range site; windbreak suitability group 6.

Wabek Series

The Wabek series consists of nearly level to steep and hilly to steep, excessively drained soils on outwash plains and steep terrace edges. These soils formed in gravel and sand outwash. The native vegetation is mainly plains muhly, needle-and-thread, and dropseed.

In a representative profile the surface layer is dark grayish-brown gravelly sandy loam about 9 inches thick. The underlying material, to a depth of 60 inches, is light brownish gray and calcareous. It is very gravelly sandy loam in the upper 5 inches and loose very gravelly sand below.

Permeability is very rapid, and runoff is slow to medium. The available water capacity is low.

Representative profile of Wabek gravelly sandy loam, 0 to 35 percent slopes, in a cultivated field, 1,000 feet west and 100 feet north of the southeast corner of sec. 36, T. 36 N., R. 58 E.:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable; 35 percent gravel; slightly effervescent; lime crust on the undersides of some pebbles; moderately alkaline; clear boundary.

C1ca—9 to 13 inches, light brownish-gray (2.5Y 6/2) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; moderate, fine, granular structure; hard, very friable; 60 percent gravel; violently effervescent; thick lime crust on undersides of pebbles; moderately alkaline; clear boundary.

C2—13 to 60 inches, light brownish-gray (2.5Y 6/2) very gravelly sand, grayish brown (2.5Y 5/2) moist; single grain; loose; 65 percent gravel, all fragments less than 3 inches in diameter; slightly effervescent; moderately alkaline.

The depth to lime is 7 to 10 inches. The Ap horizon ranges from noncalcareous to slightly calcareous. The A horizon is 20 to 50 percent gravel. The C horizon is 50 to 80 percent gravel. In some places, the C horizon is stratified with sand, gravel, or both.

Wabek soils are associated with the Manning, Williams, and Zahill soils.

WaE—Wabek gravelly sandy loam, 0 to 35 percent slopes. This excessively drained, nearly level to steep soil is on outwash plains. It has the profile described as representative of the series. Areas range from 40 to 500 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of gravelly loam or sandy loam.

Runoff is slow to medium. The hazard of soil blowing is moderate or high.

This soil is used mainly for range, but in some areas where it is intermingled with other soils it is used for crops. Crop yields are very low. Capability unit VIIe–1; Gravel range site; windbreak suitability group 6.

WbE—Wabek-Lambert complex, 15 to 35 percent slopes. This complex is on rough, broken, hilly to steep uplands along broad valleys. It is about 60 percent Wabek soils and 40 percent Lambert soils.

The Wabek and Lambert soils have profiles similar to those described as representative of their respective series, but the surface layer ranges from gravelly sandy loam to silty clay loam.

Runoff is medium.

This complex is used for range. Capability unit VIIe–1; Gravel range site; windbreak suitability group 6.

Williams Series

The Williams series consists of nearly level to gently rolling, well-drained soils on uplands. These soils formed in glacial till. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is dark grayish-brown loam about 6 inches thick. The subsoil is about 10 inches thick. It is dark grayish-brown clay loam in the upper 6 inches and grayish-brown clay loam in the lower 4 inches. The underlying material, to a depth of 60 inches, is grayish-brown, calcareous clay loam.

Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

Representative profile of Williams loam, undulating (0 to 4 percent slopes), in a cultivated field, 150 feet south and 150 feet east of the northwest corner of sec. 32, T. 32 N., R. 58 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure; slightly hard, very friable, sticky and plastic; many very fine roots; 5 percent gravel; moderately alkaline; clear boundary.

B2t—6 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, sticky and plastic; many fine roots; many, very fine, inped, simple pores; moderately thick, continuous clay films on faces of peds; clay bridging of sand grains; many, very fine, bleached sand grains on peds; 5 percent gravel; less than 1 percent stones; moderately alkaline; clear boundary.

B3—12 to 16 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; common very fine roots; common, very fine and fine, inped, simple pores; thin, continuous clay films on vertical faces of peds, patchy clay films on horizontal faces; bleached sand grains on peds; 5 percent gravel; slightly effervescent; moderately alkaline; gradual boundary.

C1ca—16 to 36 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; very hard, friable, sticky and plastic; common or few roots; common, fine, inped pores; 5 percent gravel; violently effervescent; few to many soft masses of lime; moderately alkaline; gradual boundary.

C2—36 to 60 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; very hard, friable, sticky and plastic; 1 percent stones and cobblestones; 5 percent gravel; common lignite chips; strongly effervescent; moderately alkaline.

The depth to lime ranges from 14 to 24 inches. The gravel content ranges from 1 to 10 percent throughout the profile. The B2t horizon is dark grayish brown or grayish brown. The C horizon ranges from grayish brown to light olive gray.

Williams soils are associated with Bowbells, Dooley, Dimmick, Farnuf, Grail, Turner, and Zahill soils.

WmB—Williams loam, undulating (0 to 4 percent slopes). This well-drained, nearly level and undulating soil is on uplands. It has the profile described as representative of the series. Areas range from 20 acres to more than 2,000 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of gravelly loam, stony loam, and clay loam. Also included are areas of soils in which depth to lime is less than 16 inches.

Runoff is slow or medium. The hazard of erosion is slight or moderate.

This soil is used mainly for crops, but some areas are used for range and alfalfa hay. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

WmC—Williams loam, gently rolling (4 to 8 percent slopes). This well-drained, gently rolling soil is on uplands. Areas range from 40 to 320 acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of gravelly clay loam or clay loam.

Runoff is medium. The hazard of erosion is moderate.

This soil is used mainly for crops, but some areas are used for range and alfalfa hay. Capability unit IIIe–2; Silty range site; windbreak suitability group 1.

WzB—Williams-Zahill loams, undulating (0 to 4 percent slopes). This complex consists of nearly level or undulating soils on glacial till plains. It is about 65 percent Williams loam and 35 percent Zahill loam. The Williams soil generally is in swales, and the Zahill soil is on the tops of the undulating areas.

The Williams and Zahill soils have profiles similar to those described as representative of their respective series, but in places the Williams soil has a thinner subsoil, and the Zahill soil has a surface layer of loam.

Runoff is slow to medium.

The soils in this complex are used for crops, range, and alfalfa hay. Capability unit IIIe–6; Silty range site; windbreak suitability group 1.

WzC—Williams-Zahill loams, gently rolling (4 to 8 percent slopes). This complex consists of gently rolling soils on glacial till plains. It is about 60 percent Williams loam and about 40 percent Zahill loam. The Williams soil is in swales and sloping areas, and the Zahill soil is on the top of the knolls and low ridges.

The Williams and Zahill soils have profiles similar to those described as representative of their respective series, but in places the Williams soil has a thinner subsoil, and the Zahill soil has a surface layer of clay loam.

Runoff is medium.

Most of this complex is cultivated, but some areas are used for range and alfalfa hay. The main concerns of management are controlling erosion and conserving water. Capability unit IIIe–2; Silty range site; windbreak suitability group 1.

Zahill Series

The Zahill series consists of strongly rolling to very steep, well-drained soils on uplands. These soils formed in clay loam glacial till. The native vegetation is mainly western and thickspike wheatgrass and needle-and-thread.

In a representative profile the surface layer is grayish-brown, calcareous clay loam about 6 inches thick. The underlying material, to a depth of 60 inches, is light brownish-gray and olive-gray, calcareous clay loam.

Permeability is moderately slow, and runoff is medium or rapid. The available water capacity is high.

Representative profile of Zahill clay loam, strongly rolling (8 to 15 percent slopes), in a cultivated field, 200 feet west and 100 feet south of the northeast corner of sec. 25, T. 35 N., R. 57 E.:

Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, fine, granular structure; slightly hard, friable, sticky and plastic; many roots; about 1 percent stones; 5 percent gravel; strongly effervescent; moderately alkaline; clear, abrupt boundary.

C1ca—6 to 30 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, friable, sticky and plastic; many roots; many pores; about 5 percent pebbles; violently effervescent; lime crusts on undersides of pebbles; common lime nodules; moderately alkaline; clear, wavy boundary.

C2—30 to 60 inches, olive-gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; weak, very thick, platy structure parting to moderate, fine, subangular blocky; hard, firm, sticky and plastic; few lignite chips; about 1 percent stones, 5 percent gravel; common crystals of gypsum; strongly effervescent; moderately alkaline.

The Ap horizon is grayish brown or light grayish brown. The content of stones in this horizon ranges from 0 to 10 percent, and the content of gravel from 0 to 15 percent. In sodded areas a noncalcareous A1 horizon is 2 to 4 inches thick. Depth to the C1ca horizon ranges from 2 to 9 inches. The C1ca horizon ranges from grayish brown to olive gray. This horizon has common to many masses of lime, and the content of gravel ranges from 1 to 10 percent.

Zahill soils are associated with Bowbells, Dimmick, Dooley, Lambert, and Williams soils.

ZaD—Zahill clay loam, strongly rolling (8 to 15 percent slopes). This well-drained, strongly rolling soil is on the sides and headwalls of deep drainageways on uplands. It has the profile described as representative of the series. Areas range from 20 acres to several hundred acres in size.

Included with this soil in mapping are a few areas of soils that have a surface layer of gravelly clay loam and gravelly loam.

The hazard of erosion is moderate or high. The available water capacity is moderate or high.

This soil is used mainly for crops and range, but some areas are used for alfalfa hay. Capability unit IVe–1; Silty range site; windbreak suitability group 1.

ZaE—Zahill clay loam, steep (15 to 45 percent slopes). This well-drained, calcareous, moderately steep to very steep soil is on steep sidewalls and headwalls of deep drainageways on uplands. Areas range from 20 acres to several hundred acres in size.

Included with this soil in mapping are a few areas of stony loam, clay loam, and gravelly clay loam.

The hazard of erosion is high.

This soil is used for range. Capability unit VIe–2; Thin Hilly range site; windbreak suitability group 6.

ZwE—Zahill-Williams complex, hilly (15 to 25 percent slopes). This complex consists of hilly soils on glacial till terminal moraines that have relief of about 25 to 65 feet. It is about 60 percent Zahill soils and 35 percent Williams soils. About 5 percent is Dimmick silty clay. The Zahill soils are on the crests of hills and ridges. The Williams soils are in sloping areas, and the Dimmick soil is mainly in enclosed basins.

The Zahill and Williams soils have profiles similar to those described as representative of their respective series.

Included with this complex in mapping are areas of Dimmick silty clay. Also included are a few areas of soils that have a surface layer of silt loam, gravelly loam, stony loam, or fine sandy loam.

The hazard of erosion is high.

This complex is used mainly for range, but some areas are used for crops and alfalfa hay. Capability unit VIe–2; Thin Hilly range site; windbreak suitability group 6.

Use and Management of the Soils

This section contains information about the use and

management of the soils of Sheridan County for crops, range, windbreaks, wildlife habitat, recreation, and engineering.

General Management for Crops

About 57 percent of Sheridan County is cultivated. Spring wheat is the principal crop. Oats, barley, and alfalfa hay are other important crops.

The main considerations in managing cultivated soils in the county are conserving moisture, controlling soil blowing and water erosion, and maintaining fertility.

Conserving moisture generally entails reducing evaporation, limiting runoff, increasing infiltration, and controlling weeds. Among the effective means of controlling weeds are stubble mulching, contour farming and stripcropping; using field windbreaks, buffer strips, timely tillage, and minimum tillage; making use of crop residue; and applying fertilizer. Fallow helps to control weeds and to conserve moisture.

Among the measures that help to control erosion are growing cover crops and stripcropping and using buffer strips, windbreaks, barriers of tall wheatgrass, contour farming, diversions, waterways, minimum tillage, timely tillage, emergency tillage, and crop residue. Generally, a combination of several measures is used.

Among the measures that help to maintain fertility are the application of chemical fertilizer and barnyard manure and the inclusion in the cropping system of cover crops, grasses, and legumes, as well as the use of summer fallow. Controlling erosion also helps to maintain fertility. All of the soils in the county used for cultivated crops respond to additions of fertilizer.

In places the installation of drainage, removal of stones, and reduction of salinity are practices needed to offset the effects of unfavorable soil characteristics.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of farming. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive land-forming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture, range, woodland, or wildlife habitat.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIIe. The letter *e* shows that the main limitation is risk of erosion; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some areas the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe–1 or IIIe–2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units represented in Sheridan County are described, and sugges-

tions for the use and management of the soils are given.

CAPABILITY UNIT IIIe–1

This unit consists of well-drained, nearly level to gently rolling soils on upland terraces and outwash plains. They have a surface layer of loam, a subsoil of clay loam, and a substratum of loose sand and gravel at a depth of about 25 to 60 inches or more. Available water capacity is moderate or low. Permeability is moderate in the subsoil and moderately rapid in the underlying material. The hazard of erosion is moderate.

These soils are suited to most crops commonly grown in the county. Wheat, barley, and oats are grown in a crop-fallow rotation. Alfalfa hay is also grown. These soils also are suited to flax, safflower, grass for seed, and alfalfa for seed.

The main concerns of management are controlling soil blowing and water erosion and conserving soil moisture. Stubble mulch tillage, wind stripcropping, field windbreaks, and barriers of tall wheatgrass help to control soil blowing. Contour farming, terraces, waterspreading, and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IIIe–2

This unit consists of well-drained, moderately sloping to gently rolling soils on fans and glacial till uplands. These soils have a surface layer of loam or silty clay loam and a subsoil or underlying material of clay loam to silty clay. Available water capacity is high. Permeability is slow to moderate. The hazard of erosion is moderate or high.

These soils are suited to all crops commonly grown in the county. Wheat, barley, and oats are grown in a crop-fallow rotation. Alfalfa is also grown. These soils also are suited to flax, potatoes, safflower, and grass and alfalfa for seed.

The main concerns of management are controlling soil blowing and water erosion and conserving soil moisture. Stubble mulch tillage, wind stripcropping, barriers of tall wheatgrass, and field windbreaks help to control soil blowing. Contour farming, terraces, and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IIIe–3

This unit consists of well-drained, nearly level to gently rolling soils on lowlands and uplands. These soils have a surface layer of fine sandy loam or sandy loam and a subsoil or underlying material of fine sandy loam or sandy loam. Available water capacity is moderate or high. Permeability is moderately rapid. The hazard of erosion is high.

These soils are suited to all crops commonly grown in the county. Wheat, barley, and oats are grown in a crop-fallow rotation. Alfalfa hay is also grown. They also are suited to flax, safflower, and grass and alfalfa for seed.

The main concerns of management are controlling soil blowing and water erosion, timely tillage, and conserving soil moisture. Stubble mulch tillage, wind stripcropping, field windbreaks, and barriers of tall wheatgrass help to control soil blowing. Contour farming and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IIIe–4

Dooley fine sandy loam, 6 to 12 percent slopes, is the only soil in this unit. It is a well-drained, gently rolling or strongly rolling soil on glacial till uplands. It has a surface layer of fine sandy loam, a subsoil of sandy clay loam and sandy loam, and underlying material of calcereous clay loam. Available water capacity is high. Permeability is moderate in the subsoil and moderately slow in the underlying material. The hazard of erosion is moderate or high, and the hazard of soil blowing is high.

This soil is suited to all crops commonly grown in the county. Wheat, barley, and oats are grown in a crop-fallow rotation. Alfalfa hay is also grown. These soils also are suited to flax, safflower, grass for seed, and alfalfa for seed.

The main concerns of management are controlling soil blowing and water erosion, timely tillage, and conserving soil moisture. Stubble mulch tillage, minimum tillage, wind stripcropping, field windbreaks, and barriers of tall wheatgrass help to control soil blowing. Contour farming and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IIIe–5

This unit consists of well-drained, nearly level soils on uplands and bottom lands. These soils have a surface layer of loam, silt loam, or silty clay loam and a subsoil or underlying material of silt loam to silty clay. Available water capacity is high. Permeability is slow to moderate. The hazard of erosion is slight.

These soils are suited to all crops commonly grown in the county. Wheat, barley, oats, alfalfa hay, and grass hay are the main crops. Wheat, barley, and oats are grown in a crop-fallow rotation. These soils also are suited to flax, safflower, grass for seed, and alfalfa for seed.

The main concern of management is conserving moisture. Stubble mulch tillage, wind stripcropping, field windbreaks, barriers of tall wheatgrass, and waterspreading help to conserve moisture and help to control soil blowing.

CAPABILITY UNIT IIIe–6

This unit consists of well-drained, undulating or gently sloping soils on uplands. These soils have a surface layer of loam, silt loam, or silty clay loam. The subsoil or underlying material is silt loam to silty clay. Available water capacity is high. Permeability is slow to moderate. The hazard of erosion is slight or moderate.

These soils are suited to all crops commonly grown in the county. Wheat, barley, oats, alfalfa hay, and grass hay are the main crops. Wheat, barley, and oats are grown in a crop-fallow rotation. These soils also are suited to flax, safflower, grass for seed, and alfalfa for seed.

The main concerns in management are controlling soil blowing and water erosion, conserving moisture,

and maintaining soil fertility. Stubble mulch tillage, wind stripcropping, field windbreaks, and barriers of tall wheatgrass help to control soil blowing. Waterspreading, contour farming, dikes, terraces, and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IIIe-7

Dooley fine sandy loam, 0 to 6 percent slopes, is the only soil in this unit. It is a well-drained, nearly level to gently rolling soil on glacial till uplands. It has a surface layer of fine sandy loam, a subsoil of sandy clay loam and sandy loam, and a substratum of calcareous clay loam. Available water capacity is high. Permeability is moderate in the subsoil and moderately slow in the underlying material. The hazard of water erosion is slight or moderate, and the hazard of soil blowing is moderate.

The soil is suited to all crops commonly grown in the county. Wheat, barley, and oats are grown in a crop-fallow rotation. Wheat, barley, oats, alfalfa hay, and grass hay are the main crops. This soil also is suited to flax, safflower, grass for seed, and alfalfa for seed.

The main concerns of management are controlling soil blowing and water erosion and conserving moisture. Stubble mulch tillage, wind stripcropping, field windbreaks, and barriers of tall wheatgrass help to control soil blowing. Contour farming, terraces, and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IIIw-1

Nishon loam is the only soil in this unit. It is a somewhat poorly drained or poorly drained, nearly level soil in undrained basins on glacial till uplands. It has a surface layer of loam, a subsoil of clay, and underlying material of silty clay loam. Available water capacity is high. Permeability is very slow. The hazard of erosion is slight.

This soil is suited to all crops commonly grown in the county and to wildlife habitat. Wheat, barley, and oats are grown in a crop-fallow system. Grass hay and alfalfa hay are important crops. It also is suited to flax, safflower, grass for seed, and alfalfa for seed.

The main concern of management is controlling excess run-in water during spring snowmelt and summer rains. Stubble mulch tillage helps to control soil blowing and helps to conserve soil moisture.

CAPABILITY UNIT IIIs-1

This unit consists of moderately well drained and well-drained, nearly level, calcareous, saline soils on lowlands. These soils have a surface layer of silt loam or silty clay and underlying material of loam, silt loam, silty clay loam, or silty clay. Available water capacity is moderate or high, but a high content of salt restricts the amount of water available to some plants. Permeability is moderate or slow. The hazard of erosion is slight.

These soils are suited to salt-tolerant crops and grasses. Alfalfa hay can be established with fair success if additional water can be provided. Barley, oats, wheat, grass hay, and alfalfa hay can be grown with fair success.

The main concerns of management are selecting salt-tolerant crops, timely tillage, controlling soil blowing, and controlling excess water during spring snowmelt. Stubble mulch tillage, barriers of tall wheatgrass, and wind stripcropping help to control soil blowing. Waterspreading and dikes help to control spring flooding and to provide additional moisture for crops. All of these practices also help to conserve soil moisture.

CAPABILITY UNIT IIIs-2

This unit consists of well drained and moderately well drained, nearly level or gently sloping soils on lowlands and upland lacustrine plains. These soils have a surface layer of silty clay or clay and underlying material of silty clay or clay. Available water capacity is moderate or high. Permeability is very slow or slow. The hazard of erosion is slight or moderate.

These soils are suited to all crops commonly grown in the county. Wheat, barley, and oats are grown in a crop-fallow rotation. Alfalfa hay and grass hay are important crops. These soils also have potential for growing flax, safflower, and grass and alfalfa for seed.

The main concerns of management are controlling soil blowing and water erosion, timely tillage operations, and conserving soil moisture. Stubble mulch tillage, wind stripcropping, field windbreaks, and barriers of tall wheatgrass help to control soil blowing. Waterspreading, contour farming, dikes, terraces, and grassed waterways help to reduce water erosion. All of these practices help to conserve soil moisture.

CAPABILITY UNIT IVe-1

This unit consists of well-drained or somewhat excessively drained, nearly level to strongly sloping soils on uplands. These soils have a surface layer that ranges from fine sand to clay loam and underlying material that ranges from loose sand and gravel to clay loam. The available water capacity ranges from low to high. Permeability ranges from moderately slow to rapid. The hazard of erosion is moderate or high.

These soils are suited to range, to small grain in a crop-fallow rotation, and to alfalfa hay. They also are suited to use for wildlife habitat and for recreation.

The main concerns of management are controlling soil blowing and water erosion. Stubble mulch tillage, minimum tillage, wind stripcropping, barriers of tall wheatgrass, and grassed waterways help to control soil blowing and water erosion. All of these practices help to conserve soil moisture. Proper use of range helps to maintain vegetative cover and helps to control erosion.

CAPABILITY UNIT IVe-2

Only Farnuf-Turner complex, 0 to 6 percent slopes, is in this unit. It consists of well-drained, nearly level to gently rolling soils on foot slopes and terraces in narrow dissected valleys. They have a surface layer of loam and a subsoil of clay loam. The underlying material is typically clay loam in Farnuf soils and loose sand and gravel in Turner soils. Available water capacity ranges from low to high. Permeability is moderate to very rapid. The hazard of erosion is moderate.

These soils are used mostly for range. In some small areas wheat, barley, or oats are grown in a crop-fallow rotation. Grass hay or alfalfa hay are grown in some

areas. Most of the soils are well suited to wildlife habitat.

The main concern of management is controlling water erosion. Proper use of range helps to maintain an adequate vegetative cover and helps to reduce erosion and to conserve soil moisture. Stubble mulch tillage, stripcropping, and grassed waterways help to control erosion and to conserve moisture in cropped areas.

CAPABILITY UNIT IVw–1

Dimmick silty clay is the only soil in this unit. It is a very poorly drained, nearly level soil in undrained basins on glacial till uplands. This soil has a surface layer of silty clay and underlying material of clay. Available water capacity is high. Permeability is very slow. The hazard of erosion is slight or none.

This soil is used mostly for range. In some of the larger areas wheat, barley, or oats are grown. Grass hay and alfalfa hay are also grown. Under natural conditions this soil can be cultivated about 5 to 7 years out of 10. Unless this soil is drained, the seeding of crops is usually delayed by ponding from snowmelt. Summer rainstorms also cause water to pond, and in places crops are damaged. If drained, this soil is suited to crops and hay. Natural ponds on this unit are a source of water for livestock and wildlife.

The main concern of management is controlling excess surface water. Stubble mulch tillage helps to control erosion and helps to conserve moisture.

CAPABILITY UNIT VIe–1

Blanchard fine sand, 4 to 20 percent slopes, is the only soil in this unit. It is a well-drained, gently rolling to hilly soil on stabilized sand dunes. The soil has a surface layer of fine sand and underlying material of fine sand. Available water capacity is low or moderate. Permeability is rapid. The hazard of soil blowing is high.

The main concern of management is controlling soil blowing.

This soil is used for range, wildlife habitat, and recreation.

CAPABILITY UNIT VIe–2

This unit consists of well-drained, moderately steep to very steep soils on walls of large drainageways and of hilly soils on glacial till terminal moraines. These soils have a surface layer of loam, clay loam, or silty clay loam and underlying material of clay loam or silty clay loam. Available water capacity is high. Permeability is moderately slow. The hazard of erosion is high.

These soils are used for range, wildlife habitat, and recreation.

The main concern of management is controlling water erosion.

CAPABILITY UNIT VIw–1

McKenzie silty clay loam is the only soil in this unit. It is a nearly level, poorly drained, subirrigated soil on lowlands. It has a surface layer of silty clay loam and underlying material of sandy clay, silty clay, or clay. Available water capacity is high. Permeability is very slow. There is no hazard of erosion.

This soil is used for wildlife habitat, for range, and, in favorable years, for grass hay.

CAPABILITY UNIT VIs–1

Nobe clay is the only soil in this unit. It is a moderately well drained, nearly level to moderately sloping, saline soil on lowlands and fans. It has a thin surface layer of loam, a subsoil of calcareous clay or silty clay, and a substratum of silty clay. Available water capacity is high, but a high content of salt restricts the amount of water available to some plants. Permeability is very slow. The hazard of erosion is slight.

This soil is used for range and is well suited to this use.

The main concern of management is conserving soil moisture.

CAPABILITY UNIT VIs–2

Bowdoin clay is the only soil in this unit. It is a moderately well drained, nearly level soil on lowlands. It has a surface layer of clay and underlying material of clay. Available water capacity is high. Permeability is very slow.

This soil is used for range and grass hay.

The main concern of management is maintaining a vegetative cover.

CAPABILITY UNIT VIIe–1

This unit consists of well-drained and excessively drained, nearly level to very steep soils and Shale outcrop on rough broken lands along Big Muddy Creek and its larger tributaries. The soils have a surface layer of silty clay loam or gravelly sandy loam and underlying material of silty clay loam to very gravelly sand. Available water capacity is low to high. Permeability is moderately slow to very rapid. The hazard of erosion is moderate or high.

Most of the soils are used for range, scenic areas, and recreation. The areas of Shale outcrop are barren.

The main concern of management is controlling water erosion.

CAPABILITY UNIT VIIw–4

Ustifluvents, saline, are the only soils in this unit. They are nearly level, poorly drained soils in drainageways and near saline ponds. They have a surface layer of silty clay or clay. The underlying material is stratified loam to clay. Available water capacity is high, but a high content of salt restricts the amount of water available to most plants. Permeability is slow. There is no hazard of erosion.

Most areas are barren, but some support sparse vegetation.

Predicted yields

Table 2 shows for each soil the average yield per acre of the principal crops under an improved, or high, level of management.

The yields shown in table 2 are based on farm records; on interviews with farmers, conservation district supervisors, and members of the staff of the Montana Agricultural Experiment Station; and on direct observations by soil scientists and soil conservationists. Considered in making the estimates were the prevailing climate, the characteristics of the soils, and

TABLE 2.—*Predicted average yields per acre of crops under a high level of dryland management*

[Absence of figure indicates that the crop is not commonly grown on the soil]

Soil	Wheat	Barley	Oats	Alfalfa hay	Grass hay
	Bu	*Bu*	*Bu*	*Tons*	*Tons*
Blanchard fine sand, 4 to 20 percent slopes					
Blanchard loamy sand, 4 to 12 percent slopes	13	13	25		
Bowbells silt loam, 0 to 2 percent slopes	35	55	90	3.0	1.2
Bowbells silt loam, 2 to 4 percent slopes	33	53	88	2.8	1.0
Bowdoin clay					1.2
Cherry silty clay loam, 2 to 4 percent slopes	24	40	48	1.5	
Cherry silty clay loam, 4 to 8 percent slopes	21	37	45	1.3	
Dimmick silty clay	45		90	2.5	1.5
Dooley fine sandy loam, 0 to 6 percent slopes	29	45	90	2.0	
Dooley fine sandy loam, 6 to 12 percent slopes	28	44	75	1.7	
Farnuf loam, 0 to 2 percent slopes	33	53	90	2.0	1.0
Farnuf loam, 2 to 4 percent slopes	33	53	90	2.0	1.0
Farnuf loam, 4 to 8 percent slopes	31	51	88	1.8	1.0
Farnuf-Turner complex, 0 to 6 percent slopes	18	25	40	1.3	
Grail silty clay loam	35	55	90	2.5	1.5
Havrelon silt loam	30	50	75	1.5	
Havrelon silt loam, saline	15	25	35	1.0	
Lambert silty clay loam, 2 to 4 percent slopes	24	40	48	1.2	
Lambert silty clay loam, 4 to 8 percent slopes	21	37	45		
Lambert silty clay loam, 8 to 15 percent slopes	10	15	20	.5	
Lambert-Shale outcrop complex, 15 to 65 percent slopes					
Lambert-Zahill complex, 20 to 50 percent slopes					
Lihen loamy fine sand, 0 to 6 percent slopes	13	20	30		
Lohler silty clay	28	45	65	1.2	
Lohler silty clay, saline	13	20	30	1.0	
Manning coarse sandy loam, 0 to 6 percent slopes	12	22	26		
Marias clay	28	50	85		1.0
McKenzie silty clay loam					3.0
Nishon loam	30	50	80	2.5	1.5
Nobe clay					
Parshall fine sandy loam, 2 to 6 percent slopes	22	35	50	1.5	
Savage silty clay loam, 0 to 2 percent slopes	30	50	88	1.8	
Savage silty clay loam, 2 to 4 percent slopes	30	50	88	1.8	
Savage silty clay loam, 4 to 8 percent slopes	28	48	86	1.5	
Shambo loam	30	50	88	1.8	
Tally sandy loam, 2 to 6 percent slopes	22	35	50	1.5	
Trembles fine sandy loam	22	35	50	1.5	
Turner loam, 0 to 4 percent slopes	22	35	50	1.5	
Turner loam, 4 to 8 percent slopes	20	33	47	1.5	
Ustifluvents, saline					
Wabek gravelly sandy loam, 0 to 35 percent slopes					
Wabek-Lambert complex, 15 to 35 percent slopes					
Williams loam, undulating	33	53	90	2.0	
Williams loam, gently rolling	31	51	88	1.8	
Williams-Zahill loams, undulating	26	46	64	1.5	
Williams-Zahill loams, gently rolling	24	44	60	1.0	
Zahill clay loam, strongly rolling	10	15	20	1.0	
Zahill clay loam, steep					
Zahill-Williams complex, hilly				1.0	

the influence of different kinds of management on the soils.

It should be understood that these yield figures are not intended to apply directly to specific tracts of land for any particular year, because the soils vary somewhat from place to place, management practices differ from farm to farm, and weather conditions differ from year to year. Nevertheless, these estimates appear to be as accurate a guide as can be obtained without a detailed and lengthy investigation. They are useful in showing the relative productivity of the soils.

The following are assumed to be part of an improved or high level of management.

1. Using cropping systems that maintain tilth and organic-matter content.
2. Controlling erosion to the maximum extent feasible, so that the quality of the soil is maintained or improved rather than reduced.
3. Maintaining a high level of fertility by means of soil tests and use of fertilizer in accordance with recommendations of the Montana Agricultural Experiment Station.
4. Using crop residue to the fullest extent practicable to protect and improve the soil.
5. Following minimum tillage practices where needed because of the soil hazards of compaction and erosion.
6. Using only the crop varieties that are best adapted to the climate and the soil.

7. Controlling weeds carefully by tillage and spraying.
8. Using drainage to prevent a seasonal high water table and ponding, so that wetness does not restrict yields of adapted crops.
9. Using suitable management practices to provide optimum conservation and use of both annual precipitation and irrigation water.

Windbreaks

Tree windbreaks help to reduce the impact of wind on farms and ranches. They protect farmsteads against winds, drifting snow, and soil blowing. They also provide shelter for livestock and food and cover for birds and other wildlife.

The selection of trees and shrubs that grow best on a specific kind of soil insures survival and rapid growth. This selection is most important in dryland plantings. Proper soil preparation, moisture, moisture conservation, timely planting, and weed control are necessary for the successful establishment of a windbreak. Windbreaks provide maximum benefits when planted at right angles to the prevailing winds. They should be wide enough to protect the area that needs protection. Plantings on sandy soils generally need to be protected against soil blowing until trees become established.

The broadleaf trees and shrubs commonly used for windbreak plantings are lilac, honeysuckle, green ash, Siberian elm, golden willow, white willow, cottonwood, Russian-olive, sand cherry, chokecherry, skunkbush sumac, American plum, buffaloberry, and caragana. Evergreen trees commonly used are ponderosa pine, Rocky Mountain juniper, Scotch pine, and Colorado blue spruce. The most hardy species are caragana, Russian-olive, Siberian elm, green ash, ponderosa pine, and Rocky Mountain juniper. Willows and cottonwoods do best where soils are moist throughout the year. Species that tolerate slight to moderate salinity or alkalinity are Russian-olive, buffaloberry, caragana, chokecherry, American plum, skunkbush sumac, Siberian elm, ponderosa pine, and Rocky Mountain juniper.

Windbreak suitability groups

Soil properties that are important in rating the suitability of a soil for windbreak plantings are the amount of and depth to heavy concentrations of lime, depth to bedrock, available water capacity, content of coarse fragments, permeability, degree of wetness, and presence of excessive amounts of alkali and salt.

The soils of Sheridan County have been placed in six windbreak suitability groups. The soils in the first five groups need similar management for successful plantings. Soils in group 6 are not suited to windbreak plantings. In the following paragraphs, the six windbreak suitability groups in Sheridan County are described, and the species of trees and shrubs best suited to planting on the soils are listed. To identify the soils in a windbreak suitability group, refer to the "Guide to Mapping Units" at the back of this soil survey.

WINDBREAK SUITABILITY GROUP 1

This group consists of well-drained, dark grayish-brown to gray soils that have a surface layer of loam, silt loam, fine sandy loam, clay loam, silty clay loam, silty clay, and clay. Slopes are less than 15 percent. Most of the soils have high available water capacity. In places they are mildly calcareous. Limitations for windbreak plantings are none to slight. The soils of this group are better suited to windbreak plantings than any of the other soils in the county. All of the trees and shrubs listed in the introduction to this section are suitable for planting except golden willow and cottonwood.

WINDBREAK SUITABILITY GROUP 2

This group consists of well-drained, dark grayish-brown and grayish-brown soils that have a surface layer of fine sandy loam, sandy loam, and loam. Slopes are less than 15 percent. The soils have low to high available water capacity. They are nonsaline. Trees and shrubs best suited to planting on these soils are caragana, honeysuckle, lilac, chokecherry, American plum, buffaloberry, sand cherry, Russian-olive, green ash, Siberian elm, ponderosa pine, Scotch pine, Colorado blue spruce, and Rocky Mountain juniper.

WINDBREAK SUITABILITY GROUP 3

This group consists of well-drained or somewhat excessively drained, dark grayish-brown soils that have a surface layer of loamy fine sand or coarse sandy loam. Slopes are less than 15 percent. The soils have low or moderate available water capacity. Trees and shrubs best suited to planting on these soils are caragana, buffaloberry, sand cherry, Russian-olive, Siberian elm, ponderosa pine, and Rocky Mountain juniper.

WINDBREAK SUITABILITY GROUP 4

McKenzie silty clay loam is the only soil in this group. It is a poorly drained, subirrigated soil that has a surface layer of silty clay loam. This soil has a seasonal water table at a depth of less than 48 inches. Slopes are less than 15 percent. The soil has a high available water capacity. Trees and shrubs best suited to planting on this soil are chokeberry, purple willow, buffaloberry, Russian-olive, Siberian elm, white willow, golden willow, cottonwood.

WINDBREAK SUITABILITY GROUP 5

This group consists of well-drained and moderately well drained, saline, light brownish-gray, grayish-brown, and gray soils that have a surface layer of silt loam, silty clay, or clay. Slopes are less than 15 percent. These soils have a moderate or high available water capacity, but a high content of salt restricts the amount of water available to some plants. Trees and shrubs best suited to planting on these soils are caragana, skunkbush sumac, buffaloberry, Russian-olive, and Siberian elm.

WINDBREAK SUITABILITY GROUP 6

The soils in this group are not suited to windbreak plantings. They are poorly drained. Slopes are greater than 15 percent. The soils have a low available water capacity. In addition, they have other unfavorable soil conditions, such as a high content of clay, sand dunes, and excess salt and alkali.

Range [2]

Range is made up of areas in which the climax, or potential plant community consists principally of native grasses, forbs, and shrubs. In Sheridan County, range makes up about 413,580 acres, or about 38 percent of the county. The raising of cattle, sheep, and hogs is one of the major sources of farm income.

The average annual precipitation in the county ranges from 12 to 15 inches, of which about 80 percent falls during the growing season. This amount and distribution of precipitation, in combination with a somewhat cool climate and generally favorable soil conditions, favor the growth of native grasses.

Areas of range usually are suited to use for wildlife habitat and for recreation.

Range sites and condition classes

Soils that have the capacity to produce the same kinds, amounts, and proportions of range plants are grouped into range sites. A range site is the product of all environmental factors responsible for its development.

A plant community existing in a range site that has not undergone abnormal disturbance is the potential, or climax, plant community for that site. Climax plant communities are not precise or fixed in their composition but vary within reasonable limits from year to year and from place to place.

Abnormal disturbances, such as overuse by livestock, excessive burning, erosion, or plowing, result in changes in the climax plant community or even complete destruction if disturbance is drastic enough. If the range site has not deteriorated significantly, secondary plant succession progresses in the direction of the climax plant community for the site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75; in *fair* condition if the percentage is 26 to 50; and in *poor* condition if the percentage is less than 25.

When changes occur in the climax plant community because of use by livestock or other disturbances, some plant species will increase; others will decrease. By comparing the composition of the present plant community to that of the climax plant community, it is possible to see how individual species have increased while others decreased. Plants not present in the climax community that show up in the present plant community are invaders for the site.

The composition of climax and present plant communities and other range site information provide the basis for selecting range management systems.

Management programs related to range are aimed at increasing desirable plants and restoring range to as near climax condition as possible. Some programs are designed to create or maintain plant communities somewhat removed from climax to fit specific needs in the grazing program, to provide for wildlife habitat, or for other benefits. Any management objective should be compatible with conservation objectives.

[2] JIM ROSE and BOB ROSS, range conservationists, Soil Conservation Service, assisted in preparing this section.

Descriptions of range sites

In the following pages, the range sites of Sheridan County are described, and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry vegetation for each site when it is in excellent condition. All range sites respond favorably to proper grazing practices, including systems of deferred grazing. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

SUBIRRIGATED RANGE SITE

McKenzie silty clay loam is the only soil in this range site. It is a nearly level, poorly drained, subirrigated soil on lowlands.

Following is the approximate composition, by weight, of species in the climax, or potential, plant community:

Plants	*Percent*
Switchgrass	20
Prairie cordgrass	20
Northern reedgrass	10
Bluejoint reedgrass	10
Western wheatgrass	10
Woody plants	10
Slender wheatgrass	5
Sedges	5
American mannagrass	5
Forbs	5

The estimated annual yield of air-dry vegetation is 3,500 to 5,000 pounds per acre. About 90 percent of this yield provides forage for livestock.

If this site is heavily grazed, the tall, highly productive grasses are replaced by western wheatgrass, saltgrass, sedges, Kentucky bluegrass, Canada bluegrass, forbs, and woody plants.

Most of this site is unsuited to mechanical treatment because the soils have a high water table.

SALINE LOWLAND RANGE SITE

This site consists of moderately well drained saline soils that have a surface layer of silty clay or clay. The soils are on nearly level to moderately sloping flood plains of Big Muddy Creek and its larger tributaries. Permeability is very slow. Available water capacity is high, but a high content of salt restricts the amount of water available to most plants.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	*Percent*
Alkali sacaton	30
Western wheatgrass	15
Greasewood	15
Saltgrass	10
Alkali cordgrass	10
Slender wheatgrass	10
Sedges	5
Nuttall alkaligrass	3
Squirreltail	2

The estimated annual yield of air-dry vegetation is 1,200 to 2,000 pounds per acre. About 95 percent of

this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, alkali sacaton and western wheatgrass are replaced by saltgrass, foxtail barley, curlycup gumweed, tumblegrass, and annual plants.

The site is not suited to mechanical treatment.

OVERFLOW RANGE SITE

This site consists of very poorly drained to somewhat poorly drained soils that have a surface layer of silty clay or loam. The soils are in undrained basins on nearly level to hilly glacial till uplands. Permeability is very slow, and available water capacity is high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	*Percent*
Western wheatgrass	25
Green needlegrass	20
Other tall grasses	20
Woody plants	15
Needle-and-thread	10
Slender wheatgrass	5
Perennial forbs	5

The estimated annual yield of air-dry vegetation is 1,350 to 1,800 pounds per acre. About 90 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, green needlegrass, western wheatgrass, needle-and-thread, and other tall grasses are replaced by silver sagebrush, Kentucky bluegrass, Canada bluegrass, smooth brome, tumblegrass, and annual plants.

Range condition recovery is slow where the plant cover is dominated by Kentucky bluegrass or smooth brome. Brush control is helpful in places where silver sagebrush, rosebush, or snowberry are dominant. Most of this site is not suited to mechanical improvement, because if the plant cover is destroyed, erosion is a hazard. An even balance of grazing use between this site and adjacent sites is difficult to maintain because of the shade, shelter, water, and long period of green grass on this site.

SANDS RANGE SITE

This site consists of nearly level to hilly, well-drained or somewhat excessively drained soils that have a surface layer of fine sand, loamy fine sand, or loamy sand. The soils are on uplands. Permeability is rapid, and available water capacity is moderate.

Following is the approximate composition, by weight, of species in the climax, or potential, plant community:

Plants	*Percent*
Prairie sandreed	25
Little bluestem	20
Needle-and-thread	15
Sand bluestem	10
Indian ricegrass	10
Woody plants	10
Perennial forbs	5
Upland sedges	5

The estimated annual yield of air-dry vegetation is 1,000 to 1,600 pounds per acre. About 90 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, prairie sandreed, little bluestem, sand bluestem, and Indian ricegrass are replaced by needle-and-thread, western wheatgrass, sedges, and large amounts of annual grasses and forbs.

Because erosion is a hazard on the soils of this site, extreme care must be used if mechanical treatment is applied.

SANDY RANGE SITE

This range site consists of nearly level to gently rolling, well-drained soils that have a surface layer of fine sandy loam or sandy loam. The soils are on lowlands and uplands. Permeability is moderately slow to moderately rapid, and available water capacity is moderate or high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	*Percent*
Needle-and-thread	40
Prairie sandreed	20
Little bluestem	10
Western wheatgrass	5
Indian ricegrass	5
Short grasses	5
Perennial forbs	5
Silver sagebrush	5
Sand dropseed	3
Side-oats grama	2

The estimated annual yield of air-dry vegetation is 900 to 1,300 pounds per acre. About 95 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, the highly productive grasses such as little bluestem and prairie sandreed are replaced by needle-and-thread, Sandberg bluegrass, threadleaf sedge, tumblegrass, green sagewort, and annual forbs and grasses.

This site is well suited to mechanical treatment where the landscape allows the use of farm machinery. Shallow chiseling or range pitting generally brings good response if enough of the better grasses are present. Complete seedbed preparation, followed by range seeding and deferment, is needed where range condition is poor and erosion is not a hazard. Brush control is feasible. Control of soil blowing must be considered when treating this site.

SILTY RANGE SITE

This site consists of nearly level to strongly sloping, well-drained soils that have a surface layer of loam, silt loam, silty clay loam, or clay loam (fig. 3). Permeability is moderate to moderately slow, and available water capacity is low to high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	*Percent*
Western and thickspike wheatgrass	35
Needle-and-thread	20
Short grasses	10
Green needlegrass	10
Short-awn porcupinegrass	10
Winterfat	5
Sagebrush and saveworts	5
Perennial forbs	5

The estimated annual yield of air-dry vegetation is 750 to 1,200 pounds per acre. About 95 percent of this yield provides forage for cattle, sheep, deer, and antelope.

Figure 3.—Silty range site, in the foreground, is on Lambert silty clay loam, 8 to 15 percent slopes. Thin Hilly range site, in the background, is on Lambert-Zahill complex, 20 to 50 percent slopes.

If this site is heavily grazed, the wheatgrasses, needle-and-thread, green needlegrass, and winterfat are replaced by short grasses, unpalatable forbs, club moss, and woody plants.

Response to management practices, such as proper grazing use and deferred rotation grazing, is fairly good on this site; however, in areas where blue grama and club moss grow, recovery is very slow and mechanical treatment is usually needed. Most of this site is suited to mechanical treatment. Shallow chiseling, range pitting, and contour furrowing followed by deferred grazing normally is beneficial if enough of the better grasses remain. Fringed sagewort, broom snakeweed, and other weedy plants usually need to be controlled following mechanical treatment. Complete seedbed preparation, followed by range seeding and deferred grazing, is needed in some areas. Brush control is feasible on small areas where rosebush, cinquefoil, and snowberry completely dominate the plant cover.

CLAYEY RANGE SITE

This site consists of nearly level to moderately sloping, moderately well drained or well drained soils that have a surface layer of silty clay, clay, or silty clay loam. Permeability is very slow and slow, and available water capacity is moderate or high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	*Percent*
Western and thickspike wheatgrass	45
Green needlegrass	30
Short grasses	10
Plains reedgrass	5
Perennial forbs	5
Sagebrush species	5

The estimated annual yield of air-dry vegetation is 800 to 1,200 pounds per acre. About 95 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed by livestock, the wheatgrasses and green needlegrass decrease. Perennial forbs, shortgrasses, and sagebrush increase.

This site is suited to mechanical treatment. Shallow chiseling, range pitting, contour furrowing, and range seeding generally bring satisfactory results if followed by proper management practices.

THIN HILLY RANGE SITE

This site consists of hilly to very steep, well-drained soils that have a surface layer of silty clay loam, loam, or clay loam. Permeability is moderately slow, and available water capacity is high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	Percent
Little bluestem	25
Needle-and-thread	20
Western wheatgrass	15
Prairie sandreed	10
Short-grass increasers	10
Green needlegrass	5
Side-oats grama	5
Perennial forbs	5
Woody plants	5

The estimated annual yield of air-dry vegetation is 500 to 1,000 pounds per acre. About 95 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, western wheatgrass, little bluestem, prairie sandreed, and green needlegrass are replaced by short grasses, forbs, annuals, broom snakeweed, and fringed sagewort.

This site is not suited to mechanical improvement, because of moderately steep to very steep slopes and the resulting high hazard of erosion.

SHALLOW TO GRAVEL RANGE SITE

Manning coarse sandy loam, 0 to 6 percent slopes, is the only soil in this site. It is a somewhat excessively drained soil that has a surface layer of coarse sandy loam. Loose sand and gravel are at a depth of about 24 inches. This soil is on postglacial outwash plains. Permeability is very rapid, and available water capacity is low.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	Percent
Needle-and-thread	25
Western wheatgrass	20
Prairie sandreed	10
Plains muhly	10
Threadleaf sedge	10
Short grasses	10
Little bluestem	8
Perennial forbs	5
Side-oats grama	2

The estimated annual yield of air-dry vegetation is 400 to 750 pounds per acre. About 95 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, western wheatgrass, prairie sandreed, and little bluestem are replaced by needle-and-thread, upland sedges, blue grama, Sandberg bluegrass, red three-awn, and annual forbs.

The areas of this site are easily reached and readily grazed by livestock. During most winters the snow cover is light, exposing the plants to heavy winter use that has contributed to overuse.

DENSE CLAY RANGE SITE

Bowdoin clay is the only soil in this site. It is a nearly level, moderately well drained soil that has a surface layer of clay. It is on flood plains of Big Muddy Creek and some of its larger tributaries. Permeability is very slow, and available water capacity is high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	Percent
Western wheatgrass	70
Sandberg bluegrass	5
Perennial forbs	5
Plains reedgrass	5
Squirreltail	5
Greasewood	5
Big sagebrush	5

The estimated annual yield of air-dry vegetation is 350 to 750 pounds per acre. About 90 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, western wheatgrass is replaced by foxtail barley, six-weeks fescue, curlycup gumweed, buffalobur, and prickly pear.

Response to management practices is slow. This site is not suited to mechanical treatment.

THIN BREAKS RANGE SITE

This site consists of Lambert-Shale outcrop complex, 15 to 65 percent slopes. The Lambert soil is well drained and has a surface layer of silty clay loam. Permeability is moderately slow, and available water capacity is high. Shale outcrop is excessively drained and barren. Available water capacity is low. This site is on steep, rough, broken sidewalls along Big Muddy Creek and its larger tributaries.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	Percent
Needle-and-thread	20
Western wheatgrass	15
Little bluestem	15
Bluebunch wheatgrass	10
Prairie sandreed	10
Woody plants	10
Plains muhly	5
Forbs	5
Green needlegrass	3
Side-oats grama	3
Indian ricegrass	2
Winterfat	2

The estimated annual yield of air-dry vegetation is 350 to 600 pounds per acre. About 80 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, the highly productive tall grasses are replaced by blue grama, sedges, prairie junegrass, Sandberg bluegrass, red three-awn, squirreltail, greasewood, silver sagebrush, and other woody plants.

This site is not suited to mechanical treatment.

GRAVEL RANGE SITE

This site consists of nearly level to very steep, well-drained to excessively drained soils that have a surface layer of gravelly sandy loam or silty clay loam and underlying material of gravelly sand. The soils are on outwash plains and terraces and on terrace edges, ridges, and hills of sand and gravel deposits. Permeability is moderately slow to very rapid, and available water capacity is low to high.

Following is the approximate composition, by weight, of the climax, or potential, plant community:

Plants	Percent
Plains muhly	20
Needle-and-thread	20
Sand dropseed	15
Side-oats grama	10
Plains reedgrass	10
Western wheatgrass	10
Short grasses	10
Sedges	5

The estimated annual yield of air-dry vegetation is 200 to 450 pounds per acre. About 95 percent of this yield provides forage for cattle, sheep, deer, and antelope.

If this site is heavily grazed, plains muhly, needle-and-thread, and sand dropseed are replaced by Sandberg bluegrass, blue grama, sandwort, sunflower, and annual forbs and grasses.

Response to proper grazing and deferred rotation grazing is slow. The site is not suited to mechanical treatment.

Wildlife [3]

Wildlife is a product of the land. The abundance of a species is directly related to the extent and diversity of its habitat. The relationship of wildlife to soils can be expressed as a soil-vegetation-wildlife relationship. Productive and well-managed soils generally support vigorous wildlife populations, and infertile and poorly managed soils usually support sparse populations of wildlife. Together, plants and animals constitute natural communities that are governed by many environmental factors, of which soil is a part.

White-tailed deer, mule deer, and pronghorn antelope are the big game animals in the county. Both species of deer commonly inhabit areas of brushy range in the Havrelon-Cherry, Nobe-Lohler-Bowdoin, and McKenzie soil associations on flood plains, low terraces, and alluvial fans in stream valleys. In these soil associations there are many alfalfa fields where deer feed. Deer are also found in the brushy coulee bottoms in the Lambert-Zahill and Turner-Farnuf associations in the steep and broken uplands that border the stream valleys; and in the brushy drainageways, draws, and brushy depressions in the Williams-Zahill, Zahill-Williams-Dimmick, Blanchard, Dooley-Parshall, Lihen-Parshall, and Turner-Farnuf soil associations, as well as in the gently rolling to hilly glacial till plains and the nearly level to hilly, sandy uplands.

Pronghorn antelope commonly inhabit the Blanchard, Dooley-Parshall, Lihen-Parshall, and Manning-Wabek soil associations on nearly level to hilly, sandy uplands. They feed mainly on forbs and woody plants of the range, but large herds often graze in cropland.

Upland game birds in the county are sharp-tailed grouse, gray partridge, and ring-necked pheasant. The sharp-tailed grouse and gray partridge are commonly in the Blanchard, Dooley-Parshall, Lihen-Parshall, and Manning-Wabek soil associations on nearly level to hilly uplands; in the Turner-Farnuf soil association on stream terraces; and in the Williams, Williams-Zahill, and Zahill-Williams-Dimmick soil associations on the glaciated uplands. The ring-necked pheasant inhabits brushy range and shrubby areas such as fence rows and odd areas of cropland and stream bottoms of the Havrelon-Cherry and Nobe-Lohler-Bowdoin soil associations.

Migratory waterfowl appear in great numbers during spring and fall along Big Muddy Creek, in lakes and ponds, and in the Medicine Lake National Wildlife Refuge. Many species of duck, Canadian geese, shorebirds, and pelicans are common in the area. Mallards, blue-winged teal, and pintails nest along the river and around farm ponds and shallow lakes (fig. 4). Pelicans and Canadian geese nest in the National Wildlife Refuge. Spring and fall migration seasons occasionally offer excellent opportunities to view the rare whooping cranes resting in the refuge.

[3] By RONALD F. BATCHELOR, biologist, Soil Conservation Service.

Recreation

Sheridan County is a typical Great Plains area having vast open spaces, plenty of fresh air, and blue sky. The area is rich in scenic and esthetic value, with its undulating fields of wheat, rolling range, and rough, broken, steep lands.

A large migratory wildlife refuge provides a viewing place for many species of waterfowl, shore birds, upland birds, large game animals, and small predatory animals. The fall hunting of migratory waterfowl is excellent throughout the county.

There is a high potential for camping and hiking, particularly in the rough, broken, steep lands that have wooded valleys. Here one can study geologic formations and observe wildlife in its native habitat.

In table 3 the soils of Sheridan County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails. Information on suitability of sites for buildings is in table 5.

In table 3 the soils are rated as having slight, moderate, or severe limitations for the specified use. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable, and limitations are so minor that they can easily be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils for this use are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes or stoniness that greatly increases the cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage,

Figure 4.—**Wildlife habitat for waterfowl and muskrat in open water and marsh. Open-land and brushy areas in the background provide habitat for upland wildlife.**

freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissioners, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage condition, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternative routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Evaluate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

TABLE 3.—*Limitations of the soils for recreational development*

Soil series and map symbols	Sites for tents and camp trailers	Picnic areas, parks, and extensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails
Blanchard:				
BcD	Severe: sand; subject to soil blowing; high cactus population.	Severe: sand; subject to soil blowing; high cactus population.	Severe: sand; subject to soil blowing; high cactus population.	Severe: sand; high cactus population.
BdC	Moderate: loamy sand; subject to soil blowing; high cactus population.	Moderate: loamy sand; subject to soil blowing; high cactus population.	Moderate: loamy sand; subject to soil blowing; high cactus population.	Moderate: loamy sand; subject to soil blowing; high cactus population.
Bowbells:				
BoA [1]	Slight: silt loam	Slight: silt loam	Slight: silt loam	Slight: silt loam.
BoB [1]	Slight: silt loam	Slight: silt loam	Moderate: slopes of 2 to 4 percent.	Slight: silt loam.
Bowdoin: Bw	Severe: clay; very slow permeability.	Severe: clay	Severe: clay; very slow permeability.	Severe: clay.
Cherry:				
ChB	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.
ChC	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 8 percent.	Moderate: silty clay loam.
Dimmick: Dm	Severe: hazard of flooding; silty clay.	Severe: hazard of flooding; silty clay.	Severe: hazard of flooding; silty clay.	Severe: hazard of flooding; silty clay.
Dooley:				
DoB	Slight	Slight	Slight where slopes are 0 to 2 percent.	Slight.
DoC	Slight where slopes are 6 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight where slopes are 6 to 8 percent. Moderate where slopes are 8 to 12 percent.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are more than 6 percent.	Slight: slopes of 0 to 12 percent.
Farnuf:				
FaA [1]	Slight	Slight	Slight	Slight.
FaB [1]	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight.
FaC	Slight	Slight	Moderate where slopes are 4 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
FtB	Severe: hazard of flooding during season of use.	Moderate: floods once or twice for short periods during season of use.	Moderate: in places floods once in 2 years during season of use.	Slight.
Grail: Gr	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.
Havrelon:				
Ha	Slight	Slight	Slight	Slight.
Hb	Moderate: dust	Moderate: dust	Moderate: dust	Moderate: dust.
Lambert:				
LaB	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.
LaC	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: slopes of 2 to 6 percent.	Moderate: silty clay loam.

TABLE 3.—*Limitations of the soils for recreational development*—Continued

Soil series and map symbols	Sites for tents and camp trailers	Picnic areas, parks, and extensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails
Lambert (continued)				
LaD	Moderate: slopes of 8 to 15 percent.	Moderate: slopes of 8 to 15 percent.	Severe: slopes of more than 8 percent.	Moderate: silty clay loam.
LbF	Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Severe: slopes of more than 8 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
LcF	Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Severe: slopes of more than 8 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Lihen: LhB	Moderate: loamy sand.	Moderate: loamy sand.	Moderate: loamy sand.	Moderate: loamy sand.
Lohler: Lo, Lr	Severe: silty clay	Severe: silty clay	Severe: silty clay	Severe: silty clay.
Manning: MaB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent.	Slight.
Marias: Mr	Severe: clay	Severe: clay	Severe: clay	Severe: clay.
McKenzie: Mz	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.
Nishon: Nh	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
Nobe: No	Severe: clay	Severe: clay	Severe: clay	Severe: clay.
Parshall: PaB	Slight	Slight	Moderate: slopes are 2 to 6 percent.	Slight.
Savage:				
SaA, SaB	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.
SaC	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate where slopes are 4 to 6 percent: silty clay loam. Severe where slopes are 6 to 8 percent.	Moderate: silty clay loam.
Shambo: Sh	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight.
Tally: TaB	Slight	Slight	Moderate: slopes of 2 to 6 percent.	Slight.
Trembles: Tr	Slight	Slight	Slight	Slight.
Turner:				
TuB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight.
TuC	Slight	Slight	Moderate where slopes are 4 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
Ustifluvents, saline: Uf	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.	Severe: water table above a depth of 20 inches.

TABLE 3.—*Limitations of the soils for recreational development*—Continued

Soil series and map symbols	Sites for tents and camp trailers	Picnic areas, parks, and extensive play areas	Playgrounds, athletic fields, and intensive play areas	Paths and trails
Wabek:				
WaE	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes are more than 6 percent.	Slight where slopes are 0 to 15 percent. Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
WbE	Severe where slopes are more than 15 percent.	Severe where slopes are more than 15 percent.	Severe where slopes are more than 6 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
Williams:				
WmB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight.
WmC	Slight	Slight	Moderate where slopes are 4 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
WzB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 4 percent.	Slight.
WzC	Slight	Slight	Moderate where slopes are 2 to 6 percent. Severe where slopes are 6 to 8 percent.	Slight.
Zahill:				
ZaD	Moderate: slopes of 8 to 15 percent.	Moderate: slopes of 8 to 15 percent.	Severe: slopes of more than 6 percent.	Slight where slopes are 0 to 15 percent.
ZaE	Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Severe: slopes of more than 6 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.
ZwE	Severe: slopes of more than 15 percent.	Severe: slopes of more than 15 percent.	Severe: slopes of more than 6 percent.	Moderate: slopes are 15 to 25 percent.

[1] These soils are subject to short periods of overflow; onsite investigation is needed.

7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4 and 5, which show, respectively, several estimated soil properties significant in engineering and interpretations for various engineering uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make other useful maps.

The information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 5 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have a special meaning to soil scientists. The Glossary defines many of these terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soil for engineering are the Unified system,[4] used by the Soil Conservation Service engineers, Department of Defense, and others, and the AASHTO system, adopted by the American Association of State Highway and Transportation Officials.[5]

[4] American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487–69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

[5] American Association of State Highway [and Transportation] Officials. 1961. Standard specifications for highway material and methods of sampling and testing. Ed. 8, 2 vol., illus.

TABLE 4.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percentage larger than 3 inches
				Unified	AASHTO	
	Feet	*Inches*				
Blanchard: BcD, BdC	>5	0–60	Fine sand or loamy sand	SM	A–2	
Bowbells: BoA, BoB	>5	0–15	Silt loam, loam	ML or CL	A–4	
		15–36	Clay loam	CL	A–8 or A–7	
		36–60	Clay loam	CL	A–6 or A–7	0–10
Bowdoin: Bw	>5	0–60	Clay	CH	A–7	
Cherry: ChB, ChC	>5	0–60	Silty clay loam	ML or CL	A–6 or A–7	
Dimmick: Dm	<2	0–7	Silty clay	CH	A–7	
		7–60	Clay	CH	A–7	
Dooley: DoB, DoC	>5	0–7	Fine sandy loam	SM or ML	A–4	<1
		7–15	Sandy clay loam	SC or CL	A–6	<1
		15–24	Sandy loam	SM	A–4	<1
		24–60	Clay loam	CL	A–6 or A–7	<1
*Farnuf: FaA, FaB, FaC, FtB For Turner part of FtB, see Turner series.	>5	0–7	Loam	ML or CL	A–4 or A–6	<5
		7–18	Clay loam	ML or CL	A–4 or A–6	<5
		18–60	Clay loam	ML or CL	A–4 or A–6	<5
Grail: Gr	>5	0–16	Silty clay loam	CL	A–6	
		16–48	Silty clay	CL or CH	A–7	
		48–60	Silty clay or heavy clay loam.	CL or CH	A–7 or A–6	
Havrelon:						
Ha	>5	0–60	Loam, silt loam, or silty clay loam.	ML or CL	A–4 or A–6	
Hb	>5	0–60	Loam, silt loam, or silty clay loam.	ML or CL	A–4 or A–6	
*Lambert: LaB, LaC, LaD, LbF, LcF. For Shale outcrop part of LbF, see Shale outcrop. For Zahill part of LcF, see Zahill series.	>5	0–60	Silty clay loam	ML or CL	A–6 or A–7	
Lihen: LhB	>5	0–60	Loamy fine sand, loamy sand, and sandy loam.	SM	A–2	
Lohler:						
Lo	>5	0–60	Silty clay	CL	A–7	
Lr	>5	0–60	Silty clay	CL	A–7	
Manning: MaB	>5	0–24	Coarse sandy loam	SM	A–2	<5
		24–60	Very gravelly sand	GW	A–1	5–10
Marias: Mr	>5	0–24	Clay	CH	A–7	
		24–60	Clay	CH	A–7	
McKenzie: Mz	3–4	0–20	Silty clay loam and silty clay.	CL	A–7	
		20–60	Clay	CH, CL, or SC	A–7	<5
Nishon: Nh	3–4	0–9	Loam	ML or CL	A–4	
		9–21	Clay	CH	A–7	
		21–60	Silty clay loam	CL	A–7 or A–6	
Nobe: No	>5	0–60	Silty clay	CL	A–6 or A–7	

significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the of this table. The symbol > means more than; < means less than]

Percentage passing sieve–				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Inches per hour	*Inches per inch of soil*	*pH*		
100	100	50–80	15–35	6.0–20	0.05–0.12	7.4–7.8	Low	Low.
100	95–100	90–100	70–90	0.6–2.0	0.14–0.18	6.6–7.3	Low	High.
100	95–100	90–100	70–80	0.6–2.0	0.14–0.19	7.4–7.8	Moderate	High.
90–100	90–100	90–100	70–80	0.6–2.0	0.14–0.19	7.4–8.4	Moderate	High.
100	100	90–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate.
100	100	95–100	85–95	0.6–2.0	0.16–0.20	7.4–8.4	Moderate	High.
100	100	90–100	90–95	<0.06	0.13–0.18	7.4–7.8	High	Moderate.
100	100	90–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate.
85–100	75–100	70–85	45–50	0.6–2.0	0.10–0.15	7.9–8.4	Low	High.
85–100	75–100	70–90	35–55	0.6–2.0	0.10–0.17	7.9–8.4	Low	Moderate.
85–100	75–100	60–70	35–40	0.6–2.0	0.10–0.15	7.9–8.4	Low	High.
85–100	75–100	75–100	70–80	0.2–0.6	0.16–0.18	7.9–8.4	Moderate	High.
95–100	95–100	85–95	60–75	0.6–2.0	0.17–0.22	7.9–8.4	Moderate	High.
95–100	95–100	90–100	70–80	0.6–2.0	0.14–0.19	7.9–8.4	Moderate	High.
95–100	95–100	90–100	70–80	0.6–2.0	0.14–0.19	7.9–8.4	Moderate	High.
100	100	95–100	85–95	0.2–0.6	0.16–0.20	7.9–8.4	Moderate	High.
100	100	95–100	90–95	0.2–0.6	0.13–0.18	7.9–8.4	High	Moderate.
100	100	90–100	80–95	0.2–0.6	0.13–0.18	7.9–8.4	High or moderate	Moderate or high.
100	100	90–100	70–85	0.6–2.0	0.16–0.24	7.9–9.0	Low	High.
100	100	90–100	70–85	0.6–2.0	0.15–0.20	8.5–9.0	Low	High.
100	100	95–100	85–95	0.2–0.6	0.16–0.20	7.4–8.5	Moderate	High.
100	100	70–85	25–35	6.0–20	0.08–0.12	7.4–8.4	Low	Low.
100	100	95–100	90–95	0.06–0.2	0.13–0.18	7.9–9.0	Moderate or high	Moderate.
100	100	95–100	90–95	0.06–0.2	0.11–0.15	8.4–9.6	Moderate or high	Moderate.
90–100	75–95	50–70	25–35	2.0–6.0	0.05–0.09	7.4–8.4	Low	Low.
35–50	25–50	12–35	<5	>20	0.02–0.06	7.9–8.4	Low	Low.
100	100	90–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate.
100	100	90–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate.
90–100	90–100	95–100	85–95	<0.06	0.13–0.18	8.5–9.0	Moderate	High.
80–95	80–95	85–95	45–95	<0.06	0.13–0.18	7.4–9.0	Moderate	Moderate.
100	100	85–95	60–75	0.6–2.0	0.17–0.22	7.9–8.4	Low	High.
100	100	90–100	75–95	<0.06	0.13–0.18	7.9–8.4	High	Moderate.
100	100	95–100	85–95	0.06–0.2	0.15–0.20	7.9–9.0	Moderate or high	High.
100	100	90–100	75–95	<0.06	0.13–0.18	7.9–9.0	Moderate	Moderate.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Percentage larger than 3 inches
				Unified	AASHTO	
	Feet	*Inches*				
Parshall: PaB	>5	0–24	Fine sandy loam	SM	A–4	
		24–60	Sandy loam	SM	A–4 or A–2	
Savage: SaA, SaB, SaC	>5	0–8	Silty clay loam	CL	A–7	
		8–60	Silty clay, silty clay loam, and sandy clay.	CL or CH	A–7	
Shale outcrop. Material is too variable to classify; onsite inspection is needed. Mapped only with Lambert soils.						
Shambo: Sh	>5	0–60	Silt loam	ML or CL	A–4 or A–6	
Tally: TaB	>5	0–60	Sandy loam	SM	A–4 or A–6	
Trembles: Tr	>5	0–60	Fine sandy loam	SM	A–2 or A–4	
Turner: TuB, TuC	>5	0–26	Clay loam and loam	ML or CL	A–4 or A–6	
		26–60	Very gravelly sand	GW	A–1	5–15
Ustifluvents, saline: Uf. Material is too variable to rate; onsite inspection is needed.						
*Wabek: WaE, WbE	>5	0–13	Gravelly sandy loam and very gravelly sandy loam.	GM	A–1	5–10
For Lambert part of WbE, see Lambert series.		13–60	Very gravelly sand	GW	A–1	0–10
*Williams: WmB, WmC, WzB, WzC.	>5	0–6	Loam	ML or CL	A–4 or A–6	<5
		6–16	Clay loam	CL	A–6 or A–7	<5
For Zahill part of WzB and WzC, see Zahill series.			Clay loam	CL	A–6 or A–7	<5
*Zahill: ZaD, ZaE, ZwE	>5	0–60	Clay loam	CL	A–6 or A–7	5–10
For Williams part of ZwE, see Williams series.						

In the *Unified* system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML-CL.

The *AASHTO* system is used to classify soils according to those properties that affect use of soils in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and are the poorest soils for subgrade. The AASHTO classification is given in table 4 for all soils mapped in the survey area.

Estimated properties

Several estimated soil properties significant in engineering are given in table 4. These estimates are made for representative soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 4.

Depth to bedrock, the distance from the surface of the soil to the upper surface of the rock layer, is not given in table 4, because the soils in the county are more than 60 inches deep over bedrock, and bedrock does not affect the use of the soils. Turner soils are 20 to 40 inches deep over sand and gravel.

Depth to seasonal high water table is the distance

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Frost action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Inches per hour	*Inches per inch of soil*	*pH*		
100	100	70–85	40–50	2.0–6.0	0.14–0.18	7.9–8.4	Low	High.
100	100	60–70	30–40	2.0–6.0	0.11–0.15	7.9–8.4	Low	Moderate.
100	100	95–100	85–95	0.06–0.2	0.16–0.22	7.9–8.4		
100	100	95–100	90–95	0.06–0.2	0.16–0.22	7.9–8.4	Moderate	High.
							Moderate or high	Moderate.
100	100	90–100	75–90	0.6–2.0	0.20–0.24	7.9–8.4	Low	High.
100	100	60–70	30–40	2.0–6.0	0.11–0.15	7.9–8.4	Low	Moderate.
100	100	70–85	30–50	2.0–6.0	0.14–0.18	7.9–9.0	Low	High.
90–95	85–90	80–90	70–80	0.6–2.0	0.14–0.19	7.9–8.4	Moderate	High.
35–50	25–35	12–35	0–5	>20	0.02–0.06	7.9–8.4	Low	Low.
35–50	25–50	15–40	10–20	>20	0.02–0.06	7.9–8.4	Low	Low.
25–45	15–35	10–30	0–5	>20	0.02–0.06	7.9–8.4	Low	Low.
95–100	95–100	85–95	60–75	0.6–2.0	0.17–0.22	7.9–8.4	Low	High.
95–100	90–100	85–95	65–75	0.6–2.0	0.14–0.19	7.9–8.4	Moderate	High.
85–95	80–95	75–90	65–80	0.2–0.6	0.14–0.19	7.9–8.4	Moderate	High.
85–95	80–95	75–90	60–80	0.2–0.6	0.14–0.19	7.9–8.4	Moderate	High.

from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil *texture* is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly porosity, structure, and texture. The estimates in table 4 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH value. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A high shrink-

TABLE 5.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Pond reservoir areas	Pond embankments
Blanchard: BcD, BdC.	Poor: sand	Poor for sand: excessive fines. Unsuited for gravel: no gravel.	Good	Slopes of 4 to 20 percent; low shrink-swell potential; low frost action potential; highly erodible in exposed areas; difficult to vegetate.	Rapid permeability.	High permeability when compacted; medium or high piping hazard; medium shear strength.
Bowbells: BoA, BoB	Good	Unsuited: no sand or gravel.	Poor: high frost action potential.	Moderate shrink-swell potential; high frost action potential.	No unfavorable features.	Medium or high piping hazard; fair or poor compaction; medium or low permeability when compacted.
Bowdoin: Bw	Poor: clay	Unsuited: no sand or gravel.	Poor: high shrink-swell potential.	Hazard of flooding; high shrink-swell potential; moderate frost action potential; high compressibility; low or medium shear strength.	No unfavorable features.	Fair to poor compaction; medium or low shear strength; low piping hazard; high compressibility.
Cherry: ChB, ChC	Fair: silty clay loam.	Unsuited: no sand or gravel.	Poor: high frost action potential.	High frost action potential; moderate shrink-swell potential.	Slopes of 2 to 8 percent.	Medium or high piping hazard; fair to poor compaction; low or medium shear strength.
Dimmick: Dm	Poor: very poorly drained; clay.	Unsuited: no sand or gravel.	Poor: high shrink-swell potential; seasonal high water table at a depth of less than 2 feet.	Hazard of flooding; high shrink-swell potential; moderate frost action potential; high compressibility; low or medium shear strength; seasonal high water table at a depth of less than 2 feet.	No unfavorable features; seasonal high water table at a depth of less than 2 feet.	Medium or low shear strength; fair or poor compaction; low piping hazard; high compressibility.

interpretations

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the that appear in the first column of this table]

Soil features affecting—Continued			Degree of limitation for—				
Drainage for crops and pasture	Terraces, waterways, and diversions	Water spreading	Septic tank absorption fields	Sewage lagoons	Dwellings and light industry	Sanitary landfill [1] (trench-type)	Shallow excavations
Well drained--	Fine sand or loamy sand; rapid permeability.	Fine sand or loamy sand; slopes of 4 to 20 percent; rapid permeability.	Slight where slopes are 4 to 8 percent.[2,3] Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: rapid permeability.	Slight where slopes are 4 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: rapid permeability; sand.[2]	Severe: sand; slopes are more than 15 percent in places.
Well drained--	Slopes of 0 to 4 percent; available outlets lacking in places.	Slopes of 0 to 4 percent.	Moderate: moderate permeability.[3]	Moderate: moderate permeability.	Severe: high frost action potential.	Moderate: clay loam.[3]	Moderate: clay loam.
Moderately well drained; very slow permeability.	Clay; slopes of 0 to 1 percent; available outlets lacking in places.	Very slow permeability.	Severe: very slow permeability; hazard of flooding.	Slight: very slow permeability.	Severe: hazard of flooding; high shrink-swell potential.	Severe: hazard of flooding; clay.	Severe: hazard of flooding; clay.
Well drained--	Available outlets lacking in places; slopes of 2 to 8 percent.	Slopes of 2 to 8 percent.	Moderate: moderate permeability.	Moderate where slopes are less than 7 percent: moderate permeability. Severe where slopes are more than 7 percent.	Severe: high frost action potential.	Moderate: silty clay loam.	Slight.
Very poorly drained; very slow permeability; available outlets lacking in places.	Very poorly drained; available outlets lacking in places; seasonal high water table at a depth of less than 2 feet.	Very slow permeability; seasonal high water table at a depth of less than 2 feet.	Severe: very slow permeability; hazard of flooding; seasonal high water table at a depth of less than 2 feet.	Severe: seasonal high water table at a depth of less than 2 feet.	Severe: hazard of flooding; very poorly drained.	Severe: hazard of flooding; very poorly drained; clay.	Severe: hazard of flooding; seasonal high water table at a depth of less than 2 feet; clay.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Pond reservoir areas	Pond embankments
Dooley: DoB	Fair: clay loam.	Unsuited	Poor: high frost action potential.	High frost action potential; highly erodible in exposed areas; moderate shrink-swell potential below a depth of 2 feet.	Slopes of 0 to 6 percent.	Medium or low shear strength; high piping hazard above a depth of 20 to 40 inches; medium or low permeability when compacted.
DoC	Fair: clay loam.	Unsuited	Poor: high frost action potential.	High frost action potential; highly erodible in exposed areas; moderate shrink-swell potential below a depth of 2 feet.	Slopes of 6 to 12 percent.	Medium or low shear strength; high piping hazard above a depth of 20 to 40 inches; medium or low permeability when compacted.
*Farnuf: FaA, FaB, FaC	Fair: clay loam.	Unsuited: no sand or gravel.	Poor: high frost action potential.	Moderate shrink-swell potential; high frost action potential.	Slopes of 0 to 8 percent limit storage area.	Medium or low shear strength; low or medium permeability when compacted; medium or high piping hazard.
FtB For Turner part, see Turner series.	Fair: clay loam.	Unsuited: no sand or gravel.	Poor: high frost action potential.	Hazard of flooding; high frost action potential; moderate shrink-swell potential.	Slopes of 0 to 6 percent; hazard of flooding.	Medium or low shear strength; medium or low permeability when compacted; medium or high piping hazard.
Grail: Gr	Fair above a depth of 16 inches: silty clay loam. Poor below a depth of 16 inches: silty clay.	Unsuited: no sand or gravel.	Poor: high shrink-swell potential.	High shrink-swell potential; moderate frost action potential; low or medium shear strength.	No unfavorable features.	Medium or low shear strength; fair or poor compaction; high compressibility; low piping hazard.
Havrelon: Ha	Good	Unsuited: no sand or gravel.	Poor: high frost action potential.	Hazard of flooding; high frost action potential; low shrink-swell potential.	Moderate permeability; high rate of seepage because of stratified material.	Medium or high piping hazard; good or poor compaction; low or medium shear strength.
Hb	Poor: high content of soluble salt.	Unsuited: no sand or gravel.	Poor: high frost action potential.	Hazard of flooding; high content of salt; high frost action potential; low shrink-swell potential.	High rate of seepage because of stratified material; high content of salt.	Medium or high piping hazard; fair or poor compaction; low or medium shear strength.

interpretations—Continued

Soil features affecting—Continued			Degree of limitation for—				
Drainage for crops and pasture	Terraces, waterways, and diversions	Water spreading	Septic tank absorption fields	Sewage lagoons	Dwellings and light industry	Sanitary landfill [1] (trench-type)	Shallow excavations
Well drained--	Available outlets lacking in places; slopes of 0 to 6 percent; erosion and siltation potential.	Moderately slow permeability; slopes of 0 to 6 percent.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 6 percent.	Severe: high frost action potential.	Moderate: clay loam.	Moderate: clay loam.
Well drained--	Available outlets lacking in places; slopes of 6 to 12 percent; erosion and siltation potential.	Slopes of 6 to 12 percent.	Severe: moderately slow permeability.	Moderate where slopes are 6 to 7 percent. Severe where slopes are more than 7 percent.	Severe: high frost action potential.	Moderate: clay loam.	Moderate: clay loam.
Well drained--	Slopes of 0 to 8 percent; erosion and siltation potential on steeper slopes.	Slopes of 0 to 8 percent.	Moderate: moderate permeability.	Moderate where slopes are less than 7 percent: moderate permeability. Severe where slopes are more than 7 percent.	Severe: high frost action potential.	Moderate: clay loam.	Moderate: clay loam.
Well drained, but floods about once in 2 years.	Slopes of 0 to 6 percent; highly dissected; erosion and siltation potential; floods about once in 2 years.	Uneven slopes of 0 to 6 percent; areas highly dissected.	Severe: hazard of flooding.	Moderate: moderate permeability.	Severe: hazard of flooding; high frost action potential.	Severe: hazard of flooding.	Severe: hazard of flooding.
Well drained--	Silty clay loam and silty clay.	Slopes of 0 to 2 percent.	Severe: moderately slow permeability.[3]	Slight -------	Severe: high shrink-swell potential.[3]	Severe: silty clay.[3]	Severe: silty clay.
Well drained; hazard of flooding.	Slopes of 0 to 2 percent; available outlets lacking in places.	Slopes of 0 to 2 percent.	Severe: hazard of flooding.[2]	Moderate: moderate permeability.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Well drained; high content of salt; hazard of flooding.[2]	Slopes of 0 to 2 percent; availability of outlets; high content of salt.	High content of salt; slopes of 0 to 2 percent.	Severe: hazard of flooding.[2]	Moderate: moderate permeability.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Pond reservoir areas	Pond embankments
*Lambert: LaB, LaC, LaD	Moderate: silty clay loam.	Unsuited: no sand or gravel.	Poor: high frost action potential.	High frost action potential; moderate shrink-swell potential; slopes of 2 to 15 percent.	Moderately slow permeability; slopes of 2 to 15 percent.	Medium or high piping hazard; fair or poor compaction; low or medium shear strength.
LbF, LcF Shale outcrop part of LbF too variable to rate. For Zahill part of LcF, see Zahill series.	Poor: slopes of more than 15 percent.	Unsuited: no sand or gravel.	Poor: high frost action potential.	Slopes of 15 to 65 percent; outcrops of shale; deep cuts and fills.	Slopes of 15 to 65 percent limit storage area; onsite investigation is needed.	Slopes of 15 to 65 percent; difficult to excavate.
Lihen: LhB	Poor: loamy fine sand; high hazard of soil blowing.	Poor for sand: excessive fines. Unsuited for gravel: no gravel.	Good	Highly erodible in exposed areas; low frost action potential; low shrink-swell potential.	Rapid permeability; high rate of seepage.	Medium permeability when compacted; high piping hazard; medium shear strength.
Lohler: Lo, Lr	Poor: silty clay.	Unsuited: no sand or gravel.	Poor: moderate or high shrink-swell potential.	Hazard of flooding; moderate or high shrink-swell potential; moderate frost action potential.	Slow permeability; high rate of seepage in places because of stratified material.	Medium or low shear strength.
Manning: MaB	Poor: hazard of soil blowing.	Good below a depth of 24 inches.	Good	Low shrink-swell potential; low frost action potential; exposed areas highly erodible on embankments; easy to excavate.	Rapid permeability; high rate of seepage.	Low compressibility; high permeability when compacted; good compaction; high piping hazard above a depth of 24 inches.
Marias: Mr	Poor: clay	Unsuited: no sand or gravel.	Poor: high shrink-swell potential.	High shrink-swell potential; moderate frost action potential; high compressibility; low or medium shear strength.	No unfavorable features.	Medium or low shear strength; low piping hazard; high compressibility.

interpretations—Continued

Soil features affecting—Continued			Degree of limitation for—				
Drainage for crops and pasture	Terraces, waterways, and diversions	Water spreading	Septic tank absorption fields	Sewage lagoons	Dwellings and light industry	Sanitary landfill [1] (trench-type)	Shallow excavations
Well drained	Silty clay loam; slopes of 2 to 15 percent; available outlets lacking in places; erosion and siltation potential on steeper slopes.	Slopes of 2 to 15 percent.	Severe: moderately slow permeability.	Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: high frost action potential.	Moderate: silty clay loam.	Moderate: silty clay loam.
Not applicable; slopes of 15 to 65 percent.	Slopes of 15 to 65 percent; erosion and siltation potential.	Slopes of 15 to 65 percent.	Severe: slopes of 15 to 65 percent.	Severe: slopes of more than 8 percent.	Severe: high frost action potential; slopes of 15 to 65 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Severe: slopes of 15 to 65 percent.
Well drained or somewhat excessively drained.	Loamy fine sand; rapid permeability; high erosion potential.	Slopes of 0 to 6 percent.	Slight: rapid permeability. [2]	Severe: rapid permeability. [2]	Slight [2]	Severe: rapid permeability. [2]	Slight.
Moderately well drained; slow permeability; hazard of flooding. High content of salt in Lr. [2]	Slopes of 0 to 1 percent; silty clay and clay; slow permeability.	Slopes of 0 to 1 percent; slow permeability; silty clay and clay.	Severe: slow permeability; hazard of flooding. [2]	Slight	Severe: hazard of flooding.	Severe: hazard of flooding; silty clay.	Severe: hazard of flooding; silty clay.
Somewhat excessively drained.	Very rapid permeability; slopes of 0 to 6 percent; erosion and siltation potential.	Rapid permeability; slopes of 0 to 6 percent.	Slight: very rapid permeability below a depth of 24 inches. [2]	Severe: very rapid permeability.	Slight [2]	Severe: very rapid permeability. [2]	Severe: very gravelly sand.
Well drained	Clay; slopes of 2 to 4 percent; available outlets lacking in places.	Clay; very slow permeability; slopes of 2 to 4 percent.	Severe: very slow permeability.	Moderate: slopes of 2 to 4 percent.	Severe: high shrink-swell potential.	Severe: clay	Severe: clay.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Pond reservoir areas	Pond embankments
McKenzie: Mz	Poor: poorly drained.	Unsuited	Poor: poorly drained; seasonal high water table at a depth of 3 to 4 feet.	Hazard of flooding in spring; seasonal high water table at a depth of 3 to 4 feet; moderate shrink-swell potential; moderate or high frost action potential.	Very slow permeability; seasonal high water table at a depth of 3 to 4 feet.	Not applicable
Nishon: Nh	Poor: clay below a depth of 9 inches; somewhat poorly drained or poorly drained.	Unsuited: no sand or gravel.	Poor: high shrink-swell potential; seasonal high water table at a depth of 3 to 4 feet.	Hazard of flooding; high shrink-swell potential; moderate or high frost action potential; seasonal high water table at a depth of 3 to 4 feet.	No unfavorable features; seasonal high water table at a depth of 3 to 4 feet.	Medium or low shear strength; low compacted permeability.
Nobe: No	Poor: high content of soluble salt; silty clay.	Unsuited: no sand or gravel.	Fair: moderate frost action potential.	Hazard of flooding; moderate shrink-swell potential; moderate frost action potential; high content of salt.	No unfavorable features.	Medium to low shear strength; low or medium piping hazard.
Parshall: PaB	Good	Poor for sand: excessive fines. Unsuited for gravel: no gravel.	Poor: high frost action potential.	Highly erodible in exposed areas; high frost action potential; low shrink-swell potential.	Moderately rapid permeability; high rate of seepage.	High piping hazard; fair or good compaction; medium shear strength.
Savage: SaA, SaB, SaC.	Fair: silty clay loam above a depth of 8 inches. Poor: silty clay below a depth of 8 inches.	Unsuited: no sand or gravel.	Poor: moderate or high shrink-swell potential.	Moderate or high shrink-swell potential; moderate frost action potential.	Few unfavorable features; steeper slopes limit reservoir area.	Medium or low shear strength; fair or poor compaction.
Shambo: Sh	Good	Unsuited: no sand or gravel.	Poor: high frost action potential.	High frost action potential; low shrink-swell potential.	Moderate permeability.	Medium or low shear strength; medium or high piping hazard.

interpretations—Continued

Soil features affecting—Continued			Degree of limitation for—				
Drainage for crops and pasture	Terraces, waterways, and diversions	Water spreading	Septic tank absorption fields	Sewage lagoons	Dwellings and light industry	Sanitary landfill [1] (trench-type)	Shallow excavations
Poorly drained; seasonal high water table at a depth of 3 to 4 feet; hazard of flooding.	Poorly drained; seasonal high water table at a depth of 3 to 4 feet.	Poorly drained; seasonal high water table at a depth of 3 to 4 feet.	Severe: very slow permeability; seasonal high water table at a depth of 3 to 4 feet; hazard of flooding.[2]	Severe or moderate: seasonal high water table at a depth of 3 to 4 feet.[2]	Severe: hazard of flooding; poorly drained.	Severe: hazard of flooding; poorly drained; clay.	Severe: seasonal high water table at a depth of 3 to 4 feet; clay.
Somewhat poorly drained to poorly drained; hazard of flooding.	Somewhat poorly drained; available outlets lacking in places; seasonal high water table at a depth of 3 to 4 feet.	Clay; very slow permeability; seasonal high water table at a depth of 3 to 4 feet.	Severe: very slow permeability; hazard of flooding; seasonal high water table at a depth of 3 to 4 feet.	Severe where flooding is a hazard. Slight: seasonal high water table at a depth of 3 to 4 feet.[3]	Severe: hazard of flooding; somewhat poorly drained; high shrink-swell potential.	Severe: hazard of flooding.	Severe: hazard of flooding; seasonal high water table at a depth of 3 to 4 feet.
Moderately well drained; very slow permeability; hazard of flooding; high content of salt.[2]	Vegetation difficult to establish because of salinity; slopes of 0 to 6 percent.	High salinity; clay; very slow permeability.	Severe: very slow permeability; hazard of flooding.	Slight -------	Slight where flooding is not a hazard.[2] Severe where flooding is a hazard.	Severe: hazard of flooding; silty clay.	Severe: hazard of flooding; silty clay.
Well drained--	Fine sandy loam and sandy loam; slopes of 2 to 6 percent; available outlets lacking in places; erosion and siltation potential.	Slopes of 2 to 6 percent; moderately rapid permeability.	Slight [2] ------	Severe: moderately rapid permeability.[2]	Severe: high frost action potential.	Severe: moderately rapid permeability.[2]	Slight.
Well drained--	Silty clay loam and silty clay; slopes of 0 to 8 percent; available outlets lacking in places.	Slopes of 0 to 8 percent; silty clay loam; slow permeability.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: moderate or high shrink-swell potential.	Severe: silty clay.	Severe: silty clay.
Well drained--	Silt loam; slopes of 2 to 4 percent; available outlets lacking in places.	Slopes of 2 to 4 percent.	Moderate: moderate permeability.	Moderate: moderate permeability; slopes of 2 to 4 percent.	Severe: high frost action potential.	Slight -------	Slight.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Pond reservoir areas	Pond embankments
Tally: TaB	Fair: hazard of erosion in exposed areas.	Unsuited: no sand or gravel.	Fair: moderate frost action potential.	Highly erodible in exposed areas; moderate frost action potential; low shrink-swell potential.	Moderately rapid permeability; high rate of seepage.	High piping hazard; medium shear strength.
Trembles: Tr	Fair: hazard of erosion in exposed areas.	Unsuited: no sand or gravel.	Poor: high frost action potential.	Hazard of flooding; high frost action potential; highly erodible in exposed areas.	Moderately rapid permeability; high rate of seepage.	High piping hazard; medium shear strength.
Turner: TuB, TuC	Fair: clay loam below a depth of 7 inches; 0 to 10 percent coarse fragments.	Good below a depth of 20 to 40 inches.	Poor above a depth of 20 to 40 inches: high frost action potential. Good below a depth of 20 to 40 inches: gravelly sand.	Moderate shrink-swell potential and high frost action potential above a depth of 20 to 40 inches. Low shrink-swell potential and low frost action potential below a depth of 20 to 40 inches.	Moderately rapid permeability; high rate of seepage below a depth of 20 to 40 inches.	Medium or low shear strength above a depth of 20 to 40 inches; high permeability below a depth of 20 to 40 inches when compacted; medium or high piping hazard above a depth of 20 to 40 inches.
Ustifluvents, saline: Uf. Material is too variable to interpret; onsite inspection is needed.						
*Wabek: WaE, WbE. For Lambert part of WbE, see Lambert series.	Poor: more than 15 percent coarse fragments.	Good below a depth of 13 inches.	Good	Slopes of 0 to 35 percent; low frost action potential; low shrink-swell potential; high shear strength.	Very rapid permeability; slopes of 0 to 35 percent.	High permeability when compacted; low piping hazard; high shear strength.
*Williams: WmB, WmC, WzB, WzC. For Zahill part of WzB and WzC, see Zahill series.	Fair: clay loam below a depth of 6 inches.	Unsuited	Poor: high frost action potential.	High frost action potential; moderate shrink-swell potential.	Moderately slow permeability.	Medium or low shear strength; low or medium piping hazard; fair or good compaction.

interpretations—Continued

Soil features affecting—Continued			Degree of limitation for—				
Drainage for crops and pasture	Terraces, waterways, and diversions	Water spreading	Septic tank absorption fields	Sewage lagoons	Dwellings and light industry	Sanitary landfill [1] (trench-type)	Shallow excavations
Well drained--	Sandy loam; moderately rapid permeability; slopes of 2 to 6 percent; erosion and siltation potential.	Rapid permeability; slopes of 2 to 6 percent.	Slight: moderately rapid permeability.[2]	Severe: moderately rapid permeability.[2]	Moderate: moderate frost action potential.	Severe: moderately rapid permeability.	Slight.
Well drained; hazard of flooding.	Fine sandy loam; slopes of 0 to 2 percent; moderately rapid permeability; erosion and siltation potential.	Moderately rapid permeability; slopes of 0 to 2 percent.	Severe: hazard of flooding.[2]	Severe: moderately rapid permeability.[2]	Severe: hazard of flooding.	Severe: hazard of flooding.[2]	Severe: hazard of flooding.
Well drained--	Gravelly sand at a depth of 20 to 40 inches; slopes of 0 to 8 percent.	Slopes of 0 to 8 percent.	Slight above a depth of 20 to 40 inches: moderate permeability. Moderate below a depth of 20 to 40 inches: moderately rapid permeability.	Severe: moderately rapid permeability.[2]	Severe: high frost action potential above a depth of 20 to 40 inches.[2]	Severe: moderately rapid permeability.[2]	Severe: very gravelly sand at a depth of 20 to 40 inches.
Excessively drained; slopes of 0 to 35 percent.	Very rapid permeability; slopes of 0 to 35 percent.	Very rapid permeability; slopes of 0 to 35 percent.	Slight where slopes are 0 to 8 percent: very rapid permeability.[2] Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: very rapid permeability.[2]	Slight where slopes are 0 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are more than 15 percent.	Severe: very rapid permeability.	Severe: very gravelly sand.
Well drained--	Loam and clay loam; slopes of 2 to 8 percent; available outlets lacking in places.	Slopes of 2 to 8 percent.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes are more than 7 percent.	Severe: high frost action potential.	Moderate: clay loam.	Moderate: clay loam.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Pond reservoir areas	Pond embankments
*Zahill: ZaD	Fair: clay loam; slopes of 8 to 15 percent.	Unsuited	Poor: high frost action potential.	High frost action potential; moderate shrink-swell potential; deep cuts and fills; slopes of 8 to 15 percent.	Slopes of 8 to 15 percent; limited reservoir area.	Medium or low shear strength; low or medium piping hazard; fair or good compaction.
ZaE, ZwE For Williams part of ZwE, see Williams series.	Poor: slopes of 15 to 45 percent.	Unsuited: no sand or gravel.	Poor: high frost action potential; slopes of 15 to 45 percent.	Slopes of 15 to 45 percent; deep cuts and fills; high frost action potential; moderate shrink-swell potential.	Slopes of 15 to 45 percent; limited reservoir area.	Medium or low shear strength; low or medium piping hazard; fair or good compaction.

[1] Onsite study is needed of the deep underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water in landfill deeper than 5 or 6 feet.

swell potential indicates a hazard to maintenance of structures built in, on, or of material having this rating.

Frost action potential refers to the probable effects on structures resulting from the freezing and thawing of soil material. These probable effects are important factors in selecting sites for highways and runways and are also important in planning any structure which is to be supported or abutted by soil that freezes. The action not only pertains to the heaving of soil as freezing progresses, but also to the excessive wetting and loss of soil strength during thaw.

Soils having properties that are not conducive to damage from frost action are rated *low*. Those having properties that make them moderately susceptible to frost action are rated *moderate*, and those soils with properties that make them highly susceptible to potential frost action are rated *high*.

Engineering interpretations

The interpretations in table 5 are based on the estimated engineering properties of soils shown in table 4, on test data for soils in other areas, and on the experience of engineers and soil scientists with the soils of Sheridan County. In table 5, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for highway location, drainage for crops and pasture, water spreading, pond reservoir areas, pond embankments, and terraces, waterways, and diversions. For these particular uses, table 5 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or, in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance are required.

Soil suitability is rated by the terms *good, fair,* and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate and severe.

Following are explanations of some of the columns in table 5:

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 5 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and they do not indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Highway location is affected by a high water table, steep slopes, the hazards of mass sliding and flooding, and other features of the soils.

Pond reservoir areas hold water behind a dam or

interpretations—Continued

Soil features affecting—Continued			Degree of limitation for—				
Drainage for crops and pasture	Terraces, waterways, and diversions	Water spreading	Septic tank absorption fields	Sewage lagoons	Dwellings and light industry	Sanitary landfill [1] (trench-type)	Shallow excavations
Well drained--	Slopes of 8 to 15 percent.	Slopes of 8 to 15 percent.	Severe: moderately slow permeability.	Severe: slopes of 8 to 15 percent.	Severe: high frost action potential.	Moderate: clay loam.	Moderate: clay loam; slopes of 8 to 15 percent.
Not applicable: slopes of 15 to 45 percent.	Slopes of 15 to 45 percent.	Slopes of 15 to 45 percent.	Severe: slopes of 15 to 45 percent.	Severe: slopes of 15 to 45 percent.	Severe: slopes of 15 to 45 percent.	Moderate where slopes are 15 to 25 percent. Severe where slopes are more than 25 percent.	Severe: slopes of 15 to 45 percent.

[2] Hazard of polluting water supplies.

[3] Subject to overflow from runoff; onsite investigation is needed.

embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Pond embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability or ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or ridges constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Waterways require soils that support fast-growing cover plants and that are not subject to erosion. Special care is needed to establish vegetation on soils that have low available water capacity and low fertility.

Water spreading consists of diverting runoff from a gully or watercourse onto gently sloping, absorptive land to conserve waste water or to increase plant growth, to reduce flood peaks, or to replenish groundwater supplies.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the hazard of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and has sides or embankments of compacted soil material. It is assumed that the embankment is compacted to medium density and that the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope. If the pond floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Dwellings and light industry, as rated in table 5, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, frost action, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 5 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless, every site should be investigated before it is selected.

Shallow excavations require digging or trenching to a depth of less than 6 feet; for example, excavations for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Formation and Classification of the Soils

This section describes the factors of soil formation. It also explains the system of soil classification currently used and places each soil series in the classes of that system.

Factors of Soil Formation

Soil forms through the action of the soil-forming processes on materials deposited or accumulated by wind, water, gravity, or the weathering of rocks. The characteristics of the soil at any given point are mostly determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material accumulated and has existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and after a variable period of time gradually change it into soil. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil that is formed and, in extreme cases, determines it almost entirely. Time is needed for changing parent material into soil. Usually, a long time is required for the development of distinct soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965.[6] Readers interested in further details about the system should refer to the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the differentiae used as a basis for classification are soil properties that can be observed in the field, or that can be inferred either from other properties that are observable in the field, or from the combined data of soil science and other disciplines. The properties selected for the higher categories are those that are the result of soil genesis or that affect soil genesis. In table 6 the soil series of Sheridan County are placed in categories of the current system. Classes of the current system are defined briefly in the following paragraphs.

ORDER: Ten soil orders are recognized. The differentiae for the orders are based on the kind and degree of the dominant sets of soil-forming processes. Each order is named with a word of three or four syllables ending in *sol*. An example is Mollisol.

SUBORDER: Each order is divided into suborders that are based primarily on properties that influence soil genesis and that are important to plant growth, or were selected to reflect what seemed to be the most important variables within the orders. The names of suborders have exactly two syllables. The last syllable indicates the order. An example is Boroll (*Bor*, meaning cool or cold, plus *oll*, from Mollisol).

GREAT GROUP: Soil suborders are divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons, soil moisture and temperature regimes, and in base status. The names of great groups have three or four syllables and end with the name of a suborder. The prefix added to the name of the suborder suggests something about the properties of the soil. An example is Argiboroll (*Arg*, meaning clay accumulation, plus *boroll*, the suborder of Mollisols that are cool or cold).

SUBGROUP: Great groups are divided into three kinds of subgroups: the central (typic) concept of the great groups (not necessarily the most extensive

[6] United States Department of Agriculture. 1960. Soil classification, a comprehensive system. 265 pp., illus. [Supplements issued in March 1967 and in September 1968].

TABLE 6.—*Classification of soil series*

Series	Family	Subgroup	Order
Blanchard	Mixed, frigid	Typic Ustipsamments	Entisols.
Bowbells	Fine-loamy, mixed	Pachic Argiborolls	Mollisols.
Bowdoin	Very fine, montmorillonitic, calcareous, frigid	Ustertic Torrifluvents	Entisols.
Cherry	Fine-silty, mixed, frigid	Typic Ustochrepts	Inceptisols.
Dimmick	Fine, mixed, montmorillonitic, frigid	Vertic Haplaquolls	Mollisols.
Dooley	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Farnuf	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Grail	Fine, montmorillonitic	Pachic Argiborolls	Mollisols.
Havrelon	Fine-loamy, mixed, calcareous, frigid	Typic Ustifluvents	Entisols.
Lambert	Fine-silty, mixed, calcareous, frigid	Typic Ustorthents	Entisols.
Lihen	Sandy, mixed	Entic Haploborolls	Mollisols.
Lohler	Fine, montmorillonitic, calcareous, frigid	Typic Ustifluvents	Entisols.
Manning	Coarse-loamy over sandy or sandy-skeletal, mixed	Typic Haploborolls	Mollisols.
Marias	Fine, montmorillonitic, calcareous, frigid	Ustertic Torriorthents	Entisols.
McKenzie	Fine, montmorillonitic, calcareous, frigid	Typic Haplaquepts	Inceptisols.
Nishon	Fine, montmorillonitic, frigid	Typic Albaqualfs	Alfisols.
Nobe	Fine, montmorillonitic, calcareous, frigid	Ustic Torriorthents	Entisols.
Parshall	Coarse-loamy, mixed	Pachic Haploborolls	Mollisols.
Savage	Fine, montmorillonitic	Typic Argiborolls	Mollisols.
Shambo	Fine-loamy, mixed	Typic Haploborolls	Mollisols.
Tally	Coarse-loamy, mixed	Typic Haploborolls	Mollisols.
Trembles	Coarse-loamy, mixed, calcareous, frigid	Typic Ustifluvents	Entisols.
Turner	Fine-loamy over sandy or sandy-skeletal, mixed	Typic Argiborolls	Mollisols.
Wabek	Sandy-skeletal, mixed	Entic Haploborolls	Mollisols.
Williams	Fine-loamy, mixed	Typic Argiborolls	Mollisols.
Zahill	Fine-loamy, mixed, calcareous, frigid	Typic Ustorthents	Entisols.

subgroup); the intergrades, or transitional forms to other orders, suborders, or great groups; and extragrade subgroups that have some properties that are representative of the great groups but that do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective Typic is used for the subgroup that is thought to typify the great group. An example is Typic Argiboroll.

FAMILY: Soil families group soils, of the same subgroup, that have similar enough physical and chemical properties that responses to management and manipulation for use are nearly the same for comparable phases. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineralogy, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, slope of soil, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for particle-size, mineralogy, reaction, and so on, that are used as family differentiae. An example is Typic Argiborolls, fine-loamy, mixed.

SERIES: The series consists of a group of soils that formed in a particular kind of parent material and that have horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition. The names are place names taken from the area where the soil is first defined. An example is the Dooley series.

Additional Information About the County

This section is mainly for readers who are not familiar with Sheridan County. It tells about the history and development, climate, physiography and drainage, and natural resources of the survey area.

History [7]

About 1881 the Indian wars ended, and nomadic cattle outfits began to use the lush grass plains of what is now Sheridan County. A range war raged between the cattlemen and the sheepmen until about 1910. The Homestead Act opened lands for settlement, and the cattlemen and sheepmen reluctantly made room for farmers.

A post office named Plentywood was established in about 1901, and in 1912 a vote was cast for incorporation of the town of Plentywood. The following year, 1913, Sheridan County was established.

Farms were carved from the vast, treeless plains, and today the economy is based on wheat farming and the raising of livestock.

Oil production is yet to be fully developed but is certain to be an important and increasing source of wealth.

Sheridan County, in the extreme northeast corner of Montana, is bounded on the north by the Dominion of Canada, on the west by Daniels County, on the

[7] From histories of Sheridan County. *The Plentywood Herald*, Magazine Edition, Volume 30, 1938; *Sheridan's Daybreak*, Sheridan County History, 1970; *The Golden Book of Plentywood*, 1962.

south by Roosevelt County, and on the east by North Dakota.

Plentywood, the county seat, features a community hospital, nursing home, retirement home, community swimming pool, two banks, a creamery, grain elevators, several churches, a high school, two buslines, a railroad, a museum, and an airport. There are nine outlying towns: Antelope, Dagmar, Homestead, Medicine Lake, Outlook, Raymond, Redstone, Reserve, and Westby. The county has four high schools and several grade schools. All of the outlying towns can be reached by hard-surfaced roads. State Highway 5 crosses the county east and west, and State Highways 256 and 16 cross the county north and south. A second railroad crosses the northern half of the county.

The 4-H clubs, saddle clubs, livestock organizations, wheat farmers, business organizations, and other community organizations are active, and they highlight their activities with a county fair about harvest time each year.

The population of the county reached a peak of about 25,000 in 1913 and decreased to 5,779 in 1970. Today, about one-fourth of the county population is in the city of Plentywood.

Relief and Drainage

Sheridan County was glaciated. It has an undulating to hilly landscape that has scattered intermittent ponds and lakes that are typical of the glacial till plains. The soils formed in glacial till and in material transported by water from the glacial till and from exposed siltstone bedrock. Bedrock is visible in many places, especially on valley walls and steep slopes.

Elevation ranges from a low of about 1,933 feet in the southern part of the county along Big Muddy Creek to a high of 2,600 feet about 15 miles southwest of Plentywood. The elevation at Plentywood is 2,041 feet.

Big Muddy Creek enters the county in the northwest corner from Canada and meanders southeasterly, leaving the county a few miles south of the town of Homestead. All streams and tributaries drain into Big Muddy Creek, a tributary of the Missouri River. The water level in the Medicine Lake National Wildlife Refuge is maintained by diverting water from Big Muddy Creek. Numerous ponds and small lakes are common in the eastern half of the county. These water supplies are used for wildlife, waterfowl, and domestic animals and are supplemented by manmade water structures and wells. All water for domestic use is from wells.

Sheridan County is in a migratory waterfowl flyway, and its waters attract nesting ducks, geese, pelicans, gulls, shore birds, and cranes. Fall brings excellent

TABLE 7.—*Temperature and precipitation*

MEDICINE LAKE 3SE (Elevation,

Month	Temperature				Precipitation
	Average daily maximum	Average daily minimum	Average monthly maximum	Average monthly minimum	Average total
	°F	°F	°F	°F	*Inches*
January	19	−4	42	−31	0.4
February	26	2	44	−25	.4
March	36	12	58	−15	.4
April	55	28	76	11	1.2
May	68	40	87	24	1.8
June	76	49	92	35	3.5
July	85	54	97	42	2.1
August	84	52	97	38	1.7
September	72	42	90	25	1.2
October	60	31	80	15	.7
November	39	17	62	−6	.5
December	26	4	48	−22	.3
Year	54	27	(1) 100	(2) −35	14.2

REDSTONE (Elevation, 2,109

January	19	−5	45	−34	0.3
February	27	2	48	−26	.3
March	36	12	60	−16	.3
April	54	25	76	9	1.0
May	67	36	87	21	1.7
June	77	47	93	33	2.7
July	85	51	98	40	1.9
August	84	48	98	33	1.6
September	71	38	90	19	1.2
October	59	28	79	8	.6
November	39	15	58	−9	.4
December	27	3	49	−25	.3
Year	51	24	(1) 101	(2) −39	12.3

[1] Average annual highest temperature.

hunting for waterfowl and attracts hunters from a wide area.

Climate [8]

Sheridan County's climate can generally be described as continental, with cold winters, warm summers, and a marked variation in seasonal precipitation. Precipitation averages 12 to 13 inches annually over the northwestern part of the county and 14 to 15 inches over the southeastern part. In a normal year about 80 percent of the annual precipitation falls during the April-to-September growing season. June is usually the wettest month, followed by May and July.

Snowfall is usually not heavy, averaging about 29 inches annually. Although snowfall averages are not large, compared with those for the rest of the State, heavy snows do occur infrequently, usually late in winter or early in spring. Rain usually occurs as showers, and thundershowers are fairly frequent. Some thundershowers produce hail heavy enough to damage crops. Steady, gentle rains occur in May, June, and September. Some very cold weather can occur each winter, but severe cold spells generally do not last for extended periods. Relatively mild winter weather is not uncommon.

[8] By R. A. DIGHTMAN, meteorologist in charge, National Weather Service, U.S. Department of Commerce.

Sunny weather prevails during the summer months, when sunshine averages about 70 to 80 percent of the possible hours. Interruptions in the sunny weather occur mostly during the afternoons from showers and thundershowers. A few days of very hot weather occur almost every year, but hot spells seldom last more than a few days, and the hot weather usually does not occur with high humidity. Temperature can reach highs of 90° F or more during any month from May to September, and on about half of the afternoons in July and August temperature reaches 90° F or warmer. The average length of the growing season (between the last occurrence in the spring and the first occurrence in the fall of 32° F) is about 110 days.

Winds of sufficient speed to cause some soil blowing occur almost every month. Spring is usually the windiest time of year, with winds averaging over 20 miles per hour about 15 percent of the time. Speeds of 50 miles per hour or stronger occasionally occur as a weather system crosses the State during the fall and winter, and during the summer accompany thunderstorms. The strongest winds usually come from a westerly direction. Local flash flooding caused by sudden heavy thunderstorms occurs in the county about once every 2 or 3 years.

Tables 7, 8, and 9 contain information about temperature and precipitation.

for two weather stations

1,952 feet; for the period 1941–70)

Precipitation—Continued							
One year in 10 will have—		Two years in 10 will have—		Three years in 10 will have—		Four years in 10 will have—	
Less than—	More than—	Less than—	More than—	Less than—	More than—	Less than—	More than—
Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
0.1	0.8	0.1	0.7	0.2	0.6	0.3	0.4
.1	.8	.1	.6	.2	.5	.3	.4
.1	.8	.2	.6	.2	.5	.3	.4
.3	2.0	.5	1.7	.8	1.4	1.0	1.2
.4	3.2	.7	2.3	1.2	2.0	1.4	1.6
1.6	5.6	2.0	4.8	2.3	4.0	2.6	3.2
.7	3.7	1.1	2.9	1.4	2.5	1.7	2.1
.7	3.4	1.0	2.5	1.1	1.8	1.2	1.6
.3	2.7	.4	1.6	.5	1.4	.6	1.2
.1	1.5	.2	1.0	.3	.9	.5	.7
.1	1.1	.1	.9	.2	.6	.3	.4
.1	.8	.1	.5	.2	.3	.3	.3
9.5	19.1	11.0	17.8	12.8	16.4	13.4	15.3

feet; for the period 1954–70)

0.1	0.6	0.1	0.5	0.2	0.4	0.2	0.3
.1	.6	.1	.5	.2	.3	.2	.3
.1	.7	.2	.5	.2	.4	.3	.3
.2	1.8	.3	1.5	.5	1.3	.8	1.0
.4	3.9	.7	2.7	1.0	2.0	1.2	1.6
1.0	4.4	1.5	3.6	1.8	3.2	2.2	2.8
.6	3.0	1.0	2.7	1.3	2.5	1.5	2.1
.3	3.4	.7	2.5	.9	2.2	1.1	1.6
.2	2.7	.2	1.8	.3	1.6	.4	1.2
.1	1.4	.1	1.1	.2	.9	.3	.7
.1	.8	.1	.6	.2	.5	.3	.3
.1	.7	.1	.5	.2	.4	.2	.3
8.0	18.0	9.5	15.0	10.6	13.9	11.4	12.7

[3] Average annual lowest temperature.

TABLE 8.—*Average monthly and annual snowfall*

Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
Medicine Lake 3SE	6.4	4.5	4.1	3.4	0.2	0	(1)	(1)	0.2	1.0	4.3	4.9	29.0
Plentywood	7.5	4.4	2.8	2.0	0	0	0	0	.1	1.9	4.1	5.5	28.3

[1] Trace.

TABLE 9.—*Probabilities of last freezing temperatures in spring and first in fall*

Probability	Dates for given probability and temperature		
	24° F or lower	28° F or lower	32 ° F or lower
MEDICINE LAKE (Elevation, 1,952 feet)			
Spring:			
One year in 10 later than	May 19	May 31	June 12
Two years in 10 later than	May 13	May 25	June 6
Five years in 10 later than	May 2	May 13	May 26
Fall:			
One year in 10 earlier than	September 17	September 5	August 29
Two years in 10 earlier than	September 23	September 11	September 4
Five years in 10 earlier than	October 4	September 22	September 15
WESTBY (Elevation, 2,105 feet)			
Spring:			
One year in 10 later than	May 23	May 28	June 6
Two years in 10 later than	May 17	May 22	May 31
Five years in 10 later than	May 5	May 10	May 20
Fall:			
One year in 10 earlier than	September 19	September 8	September 1
Two years in 10 earlier than	September 24	September 13	September 6
Five years in 10 earlier than	October 3	September 22	September 15

Natural Resources

The most important natural resource in Sheridan County is its soil, which is used for growing grain, hay, and forage. Wheat is the major crop. Wheat and livestock production are the major sources of farm income. About 57 percent of the county is cultivated, 41 percent is in range and tame pasture, and 2 percent is water, roads, trees, and buildings.

Water for livestock comes from natural ponds, flowing streams, stockwater dams, stockwater dugouts, and deep wells.

Dikes are constructed on nearly level bottom lands along streams and drainageways to catch the seasonal runoff and to spread the water over the soil surface. These water-spreading systems help to increase hay and grain production by providing more available moisture.

The coal resources are extensive and were used by the early settlers as heating fuel. The coal was mined from strip mines and from underground shafts. Oil and propane now replace the coal as heating fuels. Natural gas is plentiful but has not been developed for use. Oil wells are common in the northern and eastern parts of the county. The total oil resource is still being explored, and indications are that oil activities will continue for many years.

Deer and antelope provide big-game hunting. Sharp-tailed grouse, Hungarian partridge, and ring-necked pheasant provide upland bird hunting. Ducks and geese nest in the area and provide excellent hunting during the fall migration.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soils aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. A fan-shaped deposit of sand, gravel and fine material dropped by a stream where it flows out onto a level plain or meets a slower stream.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference be-

tween the amount of soil water at field capacity and the amount at wilting point. It is expressed in this survey area as inches of water in the soil profile and rated as follows:

	Inches
Very Low	2.5
Low	2.5–5.0
Moderate	5.0–7.5
High	7.5

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Effective rooting depth (soil depth). Depth to a claypan, hardpan, bedrock, or any other layer in the soil that would stop or would hinder the penetration of roots. It is the depth of soil readily penetrated by roots. Depth classes are: *Very deep,* more than 60 inches; *deep,* 40 to 60 inches; *moderately deep,* 20 to 40 inches; *shallow,* 10 to 20 inches; and *very shallow,* less than 10 inches.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gravel. A soil separate made up of pebbles, rounded or angular, that have a diameter ranging from 2.0 to 80 millimeters. The content of gravel is not used in determining the textural class of the soil.

Grazable woodland. Woodland in which the understory includes, as an integral part of the forest plant commmunity, plants that can be grazed without significantly impairing other forest values.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that in which the overlying horizons formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation commonly used in this survey area are:

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Lime. Chemically, lime is calcium oxide, but as the term is commonly used, it is also calcium carbonate and calcium hydroxide.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock in which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are:

	Inches per hour
Very slow	Less than 0.06
Slow	0.06–0.20
Moderately slow	0.20–0.60
Moderate	0.60–2.00
Moderately rapid	2.00–6.00
Rapid	6.00–20.0
Very rapid	More than 20.0

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degree of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil has formed.

Sand. Individual rock or mineral fragments in the soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that con-

tains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil or layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." Coarse texture includes sand and loamy sand; moderately coarse texture includes sandy loam and fine sandy loam; medium texture includes very fine sandy loam, loam, silt loam, and silt; moderately fine textured includes clay loam, sandy clay loam, and silty clay loam; and fine textured includes sandy clay, silty clay, and clay.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress lawns and gardens.

Tuff. Rocks formed of compacted volcanic fragments, usually less than 4 millimeters in diameter.

Water supplying capacity. The amount of precipitation less the amount that is lost by runoff and evaporation.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which it belongs. To learn about the management of a capability unit, a range site, or a windbreak suitability group, read the description of the unit, site, or group and also the introduction to the sections in which they are described. Windbreak suitability groups are described on page 28. Other information is given in tables and text as follows:

Acreage and extent, table 1, page 7.
Predicted yields, table 2, page 27.
Limitations of soils for recreation, table 3, page 35.
Engineering use of soils, tables 4 and 5, pages 38 through 53.

Map symbol	Mapping unit	Described on page	Capability unit		Range site		Windbreak suitability group
			Symbol	Page	Name	Page	Number
BcD	Blanchard fine sand, 4 to 20 percent slopes	8	VIe-1	26	Sands	30	6
BdC	Blanchard loamy sand, 4 to 12 percent slopes	8	IVe-1	25	Sands	30	6
BoA	Bowbells silt loam, 0 to 2 percent slopes	8	IIIe-5	24	Silty	30	1
BoB	Bowbells silt loam, 2 to 4 percent slopes	8	IIIe-6	24	Silty	30	1
Bw	Bowdoin clay	9	VIs-2	26	Dense Clay	32	6
ChB	Cherry silty clay loam, 2 to 4 percent slopes	9	IIIe-6	24	Silty	30	1
ChC	Cherry silty clay loam, 4 to 8 percent slopes	9	IIIe-1	24	Silty	30	1
Dm	Dimmick silty clay	10	IVw-1	26	Overflow	30	6
DoB	Dooley fine sandy loam, 0 to 6 percent slopes	10	IIIe-7	25	Sandy	30	1
DoC	Dooley fine sandy loam, 6 to 12 percent slopes	11	IIIe-4	24	Sandy	30	1
FaA	Farnuf loam, 0 to 2 percent slopes	11	IIIe-5	24	Silty	30	1
FaB	Farnuf loam, 2 to 4 percent slopes	11	IIIe-6	24	Silty	30	1
FaC	Farnuf loam, 4 to 8 percent slopes	11	IIIe-2	24	Silty	30	1
FtB	Farnuf-Turner complex, 0 to 6 percent slopes	11	IVe-2	25	Silty	30	1
Gr	Grail silty clay loam	12	IIIe-5	24	Silty	30	1
Ha	Havrelon silt loam	12	IIIe-5	24	Silty	30	1
Hb	Havrelon silt loam, saline	13	IIIs-1	25	Silty	30	5
LaB	Lambert silty clay loam, 2 to 4 percent slopes	13	IIIe-6	24	Silty	30	1
LaC	Lambert silty clay loam, 4 to 8 percent slopes	13	IIIe-2	24	Silty	30	1
LaD	Lambert silty clay loam, 8 to 15 percent slopes	13	IVe-1	25	Silty	30	1
LbF	Lambert-Shale outcrop complex, 15 to 65 percent slopes	13	VIIe-1	26	Thin Breaks	32	6
LcF	Lambert-Zahill complex, 20 to 50 percent slopes	13	VIe-2	26	Thin Hilly	31	6
LhB	Lihen loamy fine sand, 0 to 6 percent slopes	14	IVe-1	25	Sands	30	3
Lo	Lohler silty clay	14	IIIs-2	25	Clayey	31	1
Lr	Lohler silty clay, saline	14	IIIs-1	25	Clayey	31	5
MaB	Manning coarse sandy loam, 0 to 6 percent slopes	15	IVe-1	25	Shallow to Gravel	32	3
Mr	Marias clay	15	IIIs-2	25	Clayey	31	1
Mz	McKenzie silty clay loam	16	VIw-1	26	Subirrigated	29	4
Nh	Nishon loam	16	IIIw-1	25	Overflow	30	6
No	Nobe clay	17	VIs-1	26	Saline Lowland	29	5
PaB	Parshall fine sandy loam, 2 to 6 percent slopes	18	IIIe-1	24	Sandy	30	2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Range site		Windbreak suitability group
			Symbol	Page	Name	Page	Number
SaA	Savage silty clay loam, 0 to 2 percent slopes	18	IIIe-5	24	Clayey	31	1
SaB	Savage silty clay loam, 2 to 4 percent slopes	18	IIIe-6	24	Clayey	31	1
SaC	Savage silty clay loam, 4 to 8 percent slopes	18	IIIe-2	24	Clayey	31	1
Sh	Shambo loam	19	IIIe-6	24	Silty	30	1
TaB	Tally sandy loam, 2 to 6 percent slopes	19	IIIe-3	24	Sandy	30	2
Tr	Trembles fine sandy loam	20	IIIe-3	24	Sandy	30	2
TuB	Turner loam, 0 to 4 percent slopes	20	IIIe-1	24	Silty	30	2
TuC	Turner loam, 4 to 8 percent slopes	20	IIIe-1	24	Silty	30	2
Uf	Ustifluvents, saline	20	VIIw-4	26	Saline Lowland	29	6
WaE	Wabek gravelly sandy loam, 0 to 35 percent slopes	21	VIIe-1	26	Gravel	32	6
WbE	Wabek-Lambert complex, 15 to 35 percent slopes	21	VIIe-1	26	Gravel	32	6
WmB	Williams loam, undulating	21	IIIe-6	24	Silty	30	1
WmC	Williams loam, gently rolling	21	IIIe-2	24	Silty	30	1
WzB	Williams-Zahill loams, undulating	22	IIIe-6	24	Silty	30	1
WzC	Williams-Zahill loams, gently rolling	22	IIIe-2	24	Silty	30	1
ZaD	Zahill clay loam, strongly rolling	22	IVe-1	25	Silty	30	1
ZaE	Zahill clay loam, steep	22	VIe-2	26	Thin Hilly	31	6
ZwE	Zahill-Williams complex, hilly	22	VIe-2	26	Thin Hilly	31	6

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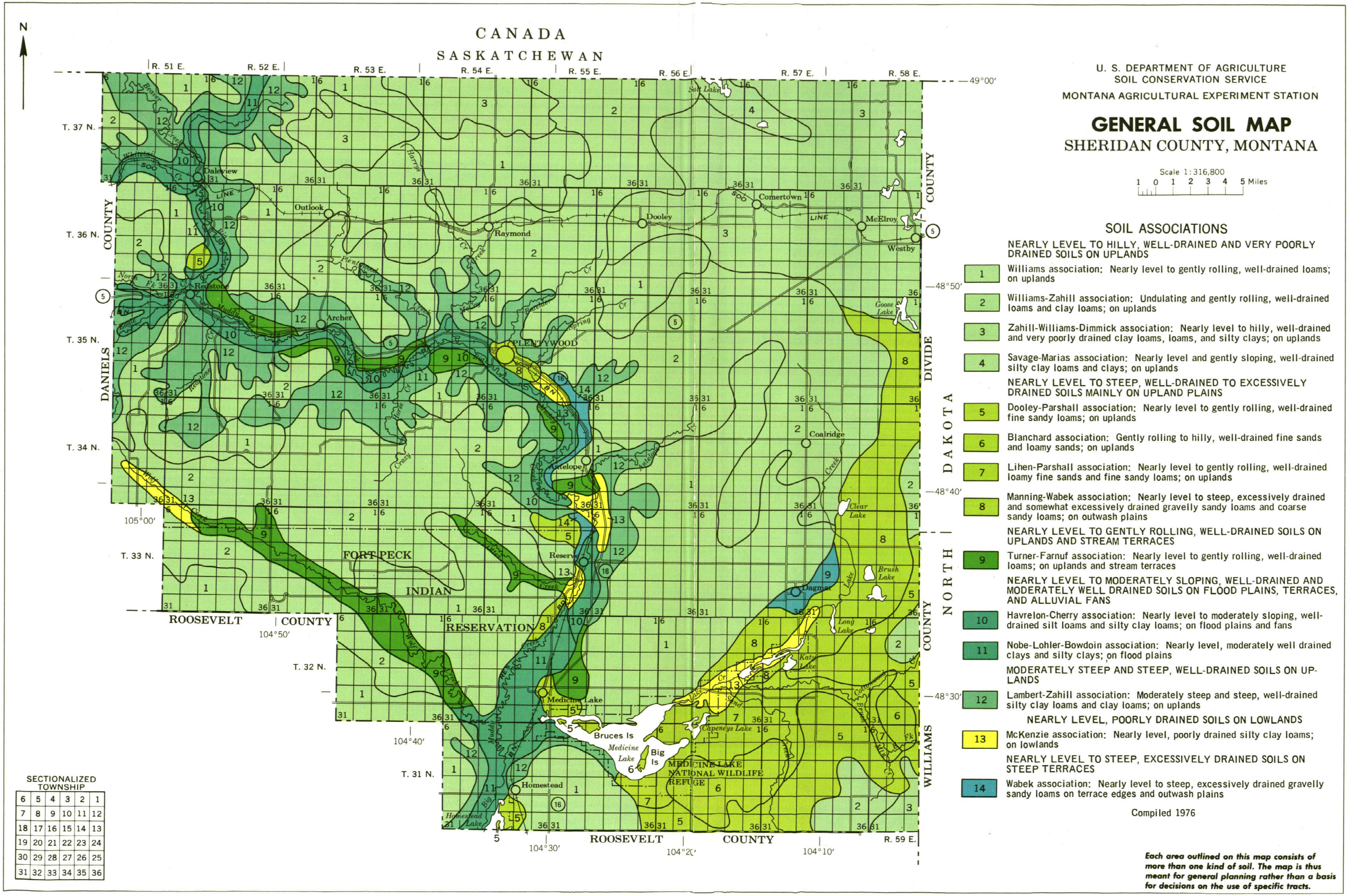
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MONTANA AGRICULTURAL EXPERIMENT STATION
GENERAL SOIL MAP
SHERIDAN COUNTY, MONTANA
Scale 1:316,800
1 0 1 2 3 4 5 Miles
SOIL ASSOCIATIONS
NEARLY LEVEL TO HILLY, WELL-DRAINED AND VERY POORLY DRAINED SOILS ON UPLANDS
1 Williams association: Nearly level to gently rolling, well-drained loams; on uplands
2 Williams-Zahill association: Undulating and gently rolling, well-drained loams and clay loams; on uplands
3 Zahill-Williams-Dimmick association: Nearly level to hilly, well-drained and very poorly drained clay loams, loams, and silty clays; on uplands
4 Savage-Marias association: Nearly level and gently sloping, well-drained silty clay loams and clays; on uplands
NEARLY LEVEL TO STEEP, WELL-DRAINED TO EXCESSIVELY DRAINED SOILS MAINLY ON UPLAND PLAINS
5 Dooley-Parshall association: Nearly level to gently rolling, well-drained fine sandy loams; on uplands
6 Blanchard association: Gently rolling to hilly, well-drained fine sands and loamy sands; on uplands
7 Lihen-Parshall association: Nearly level to gently rolling, well-drained loamy fine sands and fine sandy loams; on uplands
8 Manning-Wabek association: Nearly level to steep, excessively drained and somewhat excessively drained gravelly sandy loams and coarse sandy loams; on outwash plains
NEARLY LEVEL TO GENTLY ROLLING, WELL-DRAINED SOILS ON UPLANDS AND STREAM TERRACES
9 Turner-Farnuf association: Nearly level to gently rolling, well-drained loams; on uplands and stream terraces
NEARLY LEVEL TO MODERATELY SLOPING, WELL-DRAINED AND MODERATELY WELL DRAINED SOILS ON FLOOD PLAINS, TERRACES, AND ALLUVIAL FANS
10 Havrelon-Cherry association: Nearly level to moderately sloping, well-drained silt loams and silty clay loams; on flood plains and fans
11 Nobe-Lohler-Bowdoin association: Nearly level, moderately well drained clays and silty clays; on flood plains
MODERATELY STEEP AND STEEP, WELL-DRAINED SOILS ON UPLANDS
12 Lambert-Zahill association: Moderately steep and steep, well-drained silty clay loams and clay loams; on uplands
NEARLY LEVEL, POORLY DRAINED SOILS ON LOWLANDS
13 McKenzie association: Nearly level, poorly drained silty clay loams; on lowlands
NEARLY LEVEL TO STEEP, EXCESSIVELY DRAINED SOILS ON STEEP TERRACES
14 Wabek association: Nearly level to steep, excessively drained gravelly sandy loams on terrace edges and outwash plains
Compiled 1976
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.
SECTIONALIZED TOWNSHIP
6 5 4 3 2 1
7 8 9 10 11 12
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
N
CANADA
SASKATCHEWAN
R. 51 E.
R. 52 E.
R. 53 E.
R. 54 E.
R. 55 E.
R. 56 E.
R. 57 E.
R. 58 E.
R. 59 E.
T. 37 N.
T. 36 N.
T. 35 N.
T. 34 N.
T. 33 N.
T. 32 N.
T. 31 N.
49°00′
48°50′
48°40′
48°30′
105°00′
104°50′
104°40′
104°30′
104°20′
104°10′
DANIELS COUNTY
ROOSEVELT COUNTY
DIVIDE COUNTY
NORTH DAKOTA
WILLIAMS COUNTY
FORT PECK INDIAN RESERVATION
Daleview
Outlook
Raymond
Dooley
Comertown
McElroy
Westby
Redstone
Archer
PLENTYWOOD
Antelope
Reserve
Coalridge
Dagmar
Medicine Lake
Homestead
Salt Lake
Goose Lake
Clear Lake
Brush Lake
Long Lake
Katy Lake
Capeneys Lake
Homestead Lake
Bruces Is
Big Is
MEDICINE LAKE NATIONAL WILDLIFE REFUGE
SOO LINE
BN

INDEX TO MAP SHEETS
SHERIDAN COUNTY, MONTANA

Scale 1:316,800
1 0 1 2 3 4 5 Miles

CANADA
SASKATCHEWAN

R. 51 E. | R. 52 E. | R. 53 E. | R. 54 E. | R. 55 E. | R. 56 E. | R. 57 E. | R. 58 E.

49°00′

T. 37 N.

Inset, sheet 1

Inset, sheet 26

T. 36 N.

Inset, sheet 26

T. 35 N.

Inset, sheet 68

T. 34 N.

Inset, sheet 51

105°00′

T. 33 N.

ROOSEVELT COUNTY

104°50′

T. 32 N.

104°40′

T. 31 N.

104°30′

Inset, sheet 93

ROOSEVELT COUNTY

104°20′

Inset, sheet 94

104°10′

R. 59 E.

48°50′

48°40′

48°30′

DANIELS COUNTY

SHERIDAN COUNTY

WILLIAMS COUNTY

NORTH DAKOTA

FORT PECK INDIAN RESERVATION

MEDICINE LAKE NATIONAL WILDLIFE REFUGE

Daleview
Outlook
Raymond
Dooley
Comertown
McElroy
Westby
Redstone
Archer
PLENTYWOOD
Coalridge
Antelope
Reserve
Dagmar
Medicine Lake
Bruces Is
Big Is
Homestead

Beaver Creek
Whitetail Creek
Salt Lake
Harrys Creek
Big Muddy Creek
Plentywood Creek
Box Elder Cr
Spring Creek
North Fk Redstone Cr
Muddy Creek
Eagle Creek
Redstone Cr
Flat Cr
Crazy Creek
Antelope Creek
Wolf Creek
Otter Creek
Big Muddy Cr
Medicine Lake
Sand Lake
Cottonwood Cr
Middle Fk Mtn Cr
Mtn Cr
Homestead Lake
Goose Lake
Clear Lake
Brush Lake
Long Lake
Katy Lake
Capeneys Lake

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils.

SYMBOL	NAME
BcD	Blanchard fine sand, 4 to 20 percent slopes
BdC	Blanchard loamy sand, 4 to 12 percent slopes
BoA	Bowbells silt loam, 0 to 2 percent slopes
BoB	Bowbells silt loam, 2 to 4 percent slopes
Bw	Bowdoin clay
ChB	Cherry silty clay loam, 2 to 4 percent slopes
ChC	Cherry silty clay loam, 4 to 8 percent slopes
Dm	Dimmick silty clay
DoB	Dooley fine sandy loam, 0 to 6 percent slopes
DoC	Dooley fine sandy loam, 6 to 12 percent slopes
FaA	Farnuf loam, 0 to 2 percent slopes
FaB	Farnuf loam, 2 to 4 percent slopes
FaC	Farnuf loam, 4 to 8 percent slopes
FtB	Farnuf-Turner complex, 0 to 6 percent slopes
Gr	Grail silty clay loam
Ha	Havrelon silt loam
Hb	Havrelon silt loam, saline
LaB	Lambert silty clay loam, 2 to 4 percent slopes
LaC	Lambert silty clay loam, 4 to 8 percent slopes
LaD	Lambert silty clay loam, 8 to 15 percent slopes
LbF	Lambert-Shale outcrop complex, 15 to 65 percent slopes
LcF	Lambert-Zahill complex, 20 to 50 percent slopes
LhB	Lihen loamy fine sand, 0 to 6 percent slopes
Lo	Lohler silty clay
Lr	Lohler silty clay, saline
MaB	Manning coarse sandy loam, 0 to 6 percent slopes
Mr	Marias clay
Mz	McKenzie silty clay loam
Nh	Nishon loam
No	Nobe clay
PaB	Parshall fine sandy loam, 2 to 6 percent slopes
SaA	Savage silty clay loam, 0 to 2 percent slopes
SaB	Savage silty clay loam, 2 to 4 percent slopes
SaC	Savage silty clay loam, 4 to 8 percent slopes
Sh	Shambo loam
TaB	Tally sandy loam, 2 to 6 percent slopes
Tr	Trembles fine sandy loam
TuB	Turner loam, 0 to 4 percent slopes
TuC	Turner loam, 4 to 8 percent slopes
Uf	Ustifluvents, saline
WaE	Wabek gravelly sandy loam, 0 to 35 percent slopes
WbE	Wabek-Lambert complex, 15 to 35 percent slopes
WmB	Williams loam, undulating
WmC	Williams loam, gently rolling
WzB	Williams-Zahill loams, undulating
WzC	Williams-Zahill loams, gently rolling
ZaD	Zahill clay loam, strongly rolling
ZaE	Zahill clay loam, steep
ZwE	Zahill-Williams complex, hilly

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 1

SHERIDAN COUNTY, MONTANA NO. 1

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 050 000 FEET

760 000 FEET

740 000 FEET

730 000 FEET

R. 51 E.

3 070 000 FEET (Joins lower right)

T. 37 N.

DANIELS COUNTY

19 20 29 30 31 32

WzC ZwE WmB ZaE WzB LbF LcF Ha FaB

SOIL SURVEY

LIMIT OF

ST. PAUL MINNEAPOLIS & MANITOBA

STE. MARIE SAULT

(Joins sheet 10)

(Joins inset B, sheet 26)

3 075 000 FEET

DOMINION OF CANADA

R. 51 E.

31 32 6 5 7 8 18 17

ZaE FaB Ha ZaD WzC ZwE WmB WaE LcF Nh WzB No FaC LaC Dm

750 000 FEET

(Joins sheet 2)

(Joins inset, upper left)

3 075 000 FEET

1

N

2 Miles

10000 Feet

Scale 1:24000

5000 4000 3000 2000 1000 0 0 1000 2000 3000 4000 5000

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 2

(2)

N

DOMINION OF CANADA

LIMIT OF SOIL SURVEY

R. 51 E. | R. 52 E

SASKATCHEWAN

3 105 000 FEET

760 000 FEET

T. 37 N

(Joins sheet 1)

(Joins sheet 3)

750 000 FEET

(Joins sheet 10) | 3 080 000 FEET

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 2

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 3

3

N

SHERIDAN COUNTY, MONTANA NO. 3

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3 110 000 FEET

DOMINION OF CANADA

SASKATCHEWAN

R. 52 E. | R. 53 E.

760 000 FEET

T. 37 N.

(Joins sheet 2)

(Joins sheet 11)

750 000 FEET

3 135 000 FEET

(Joins sheet 4)

2 Miles

10000 Feet

5000

Scale 1:24000

1 0 1 000 2000 3000 4000 5000

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 4

4

N

DOMINION OF CANADA

SASKATCHEWAN

R. 53 E. | R. 54 E.

3 160 000 FEET

765 000 FEET

T. 37 N.

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 12)

3 140 000 FEET

750 000 FEET

LIMIT OF SOIL SURVEY

int

water

2 Miles 1 0 1

10000 Feet 5000 0 5000

Scale 1:24000

1 0 1 ¼ ½ ¾ 1

1000 2000 3000 4000 5000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 4

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 5

5

N

SHERIDAN COUNTY, MONTANA NO. 5

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 165 000 FEET

DOMINION OF CANADA

R. 54 E.

SASKATCHEWAN

765 000 FEET

LIMIT OF SOIL SURVEY

T. 37 N.

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 13)

755 000 FEET

3 190 000 FEET

2 Miles

10 000 Feet

Scale 1:24000

6

N

DOMINION OF CANADA

R. 55 E.

SASKATCHEWAN

SOIL SURVEY LIMIT OF

3 220 000 FEET

765 000 FEET

T. 37 N.

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 14)

755 000 FEET

3 195 000 FEET

2 Miles

10000 Feet

Scale 1:24000

5000 0 1000 2000 3000 4000 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 6

SHERIDAN COUNTY, MONTANA NO. 7

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

7

N

R. 55 E. R. 56 E. 3 225 000 FEET DOMINION OF CANADA SASKATCHEWAN

T. 37 N.

765 000 FEET

760 000 FEET

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 15)

3 250 000 FEET

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 0 1/4 1000 1/2 2000 3/4 3000 1 4000 1 1/4 5000

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 8

8

N

R. 56 E. | R. 57 E. | DOMINION OF CANADA | SASKATCHEWAN

3 275 000 FEET

770 000 FEET

760 000 FEET

3 255 000 FEET

T. 37 N.

(Joins sheet 7)

(Joins sheet 16)

(Joins sheet 01)

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 8

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SHERIDAN COUNTY, MONTANA NO. 9

3 280 000 FEET

R. 57 E. | R. 58 E.

DOMINION OF CANADA

SASKATCHEWAN

770 000 FEET

T. 37 N.

DIVIDE COUNTY

SOIL SURVEY

NORTH DAKOTA

(Joins sheet 8)

(Joins sheet 17)

3 305 000 FEET

760 000 FEET

9

N

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 0

1 5000 ½ 1000

1 5000 ¼ 2000

1 5000 ¾ 3000

1 5000 ¼ 4000

1 5000 ¾ 5000

10

N

2 Miles

10000 Feet

1 5000

Scale 1:24000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1 5000

(Joins inset A, sheet 1)

(Joins sheet 2)

R. 51 E.

R. 52 E.

3 105 000 FEET

745 000 FEET

T. 37 N.

(Joins sheet 11)

730 000 FEET

3 080 000 FEET

(Joins sheet 18)

MINNEAPOLIS ST. PAUL AND SAULT STE. MARIE

Whitetail Creek

Beaver Creek

21 22 23 24 19 20

28 27 26 25 30 29

33 34 35 36 31 32

WzB WzC LbF LcF LaC LaD No Ha WmB ZaE ChB ChC WaE DoB WaB LaB SaB Lo Ut Hb FaB WbE TuB

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SHERIDAN COUNTY, MONTANA NO. 10

SHERIDAN COUNTY, MONTANA NO. 11

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

11

N

2 Miles

10,000 Feet

Scale 1:24000

5000 4000 3000 2000 1000 0 0 1000 2000 3000 4000 5000

1 1/4 1/2 3/4 0 1/4 1/2 3/4 1

3 110 000 FEET

735 000 FEET

T. 37 N.

R. 52 E.

R. 53 E.

(Joins sheet 3)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 19)

3 135 000 FEET

ChB SaC LbF FaA LcF ZwE WzB WzC BoA WmB Gr ZaD LaC ZaE WmC TuB FaB WmC

12

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 4)

R. 53 E.

R. 54 E.

3 165 000 FEET

745 000 FEET

T. 37 N.

(Joins sheet 11)

735 000 FEET

(Joins sheet 20)

3 140 000 FEET

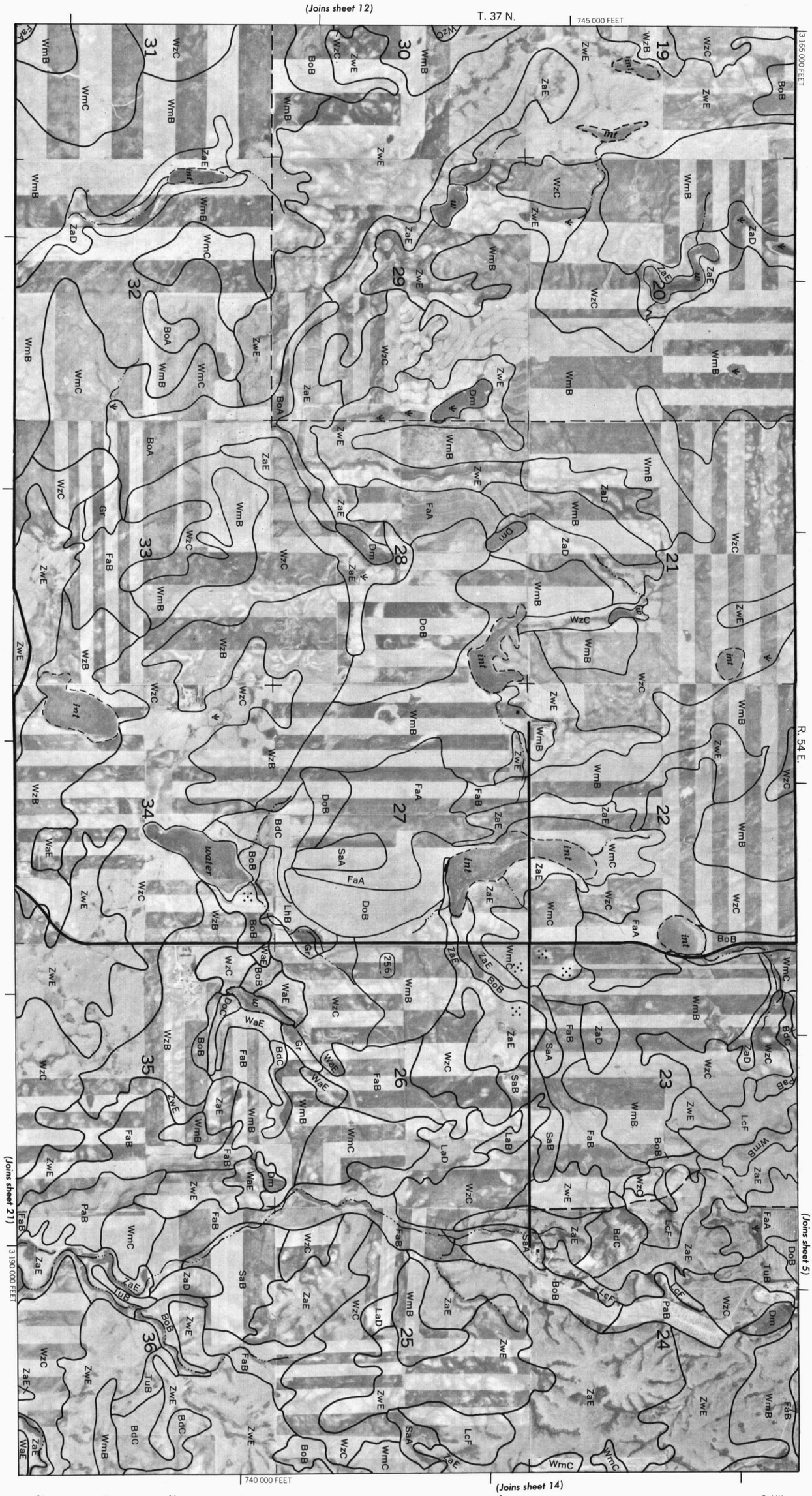
(Joins sheet 13)

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 12

SHERIDAN COUNTY, MONTANA NO. 13

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SHERIDAN COUNTY, MONTANA — SHEET NUMBER 13

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

Scale 1:24000

N

13

14

N

Scale 1:24000

2 Miles 10000 Feet 5000 1 0 1 2 3 4 5000

(Joins sheet 6)

R. 55 E.

3 220 000 FEET

750 000 FEET

740 000 FEET

3 195 000 FEET

(Joins sheet 13)

(Joins sheet 22)

(Joins sheet 15)

T. 37 N.

19 20 21 22 23 24

30 29 28 27 26 25

31 32 33 34 35 36

WmB WmC ZwE ZaE ZaD WzC BoB BoA TuB WaE SaB FaB Dm Gr Nh water

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 14

15

N

R. 55 E. | R. 56 E.

3 225 000 FEET

(Joins sheet 7)

750 000 FEET

T. 37 N.

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 23)

3 250 000 FEET

740 000 FEET

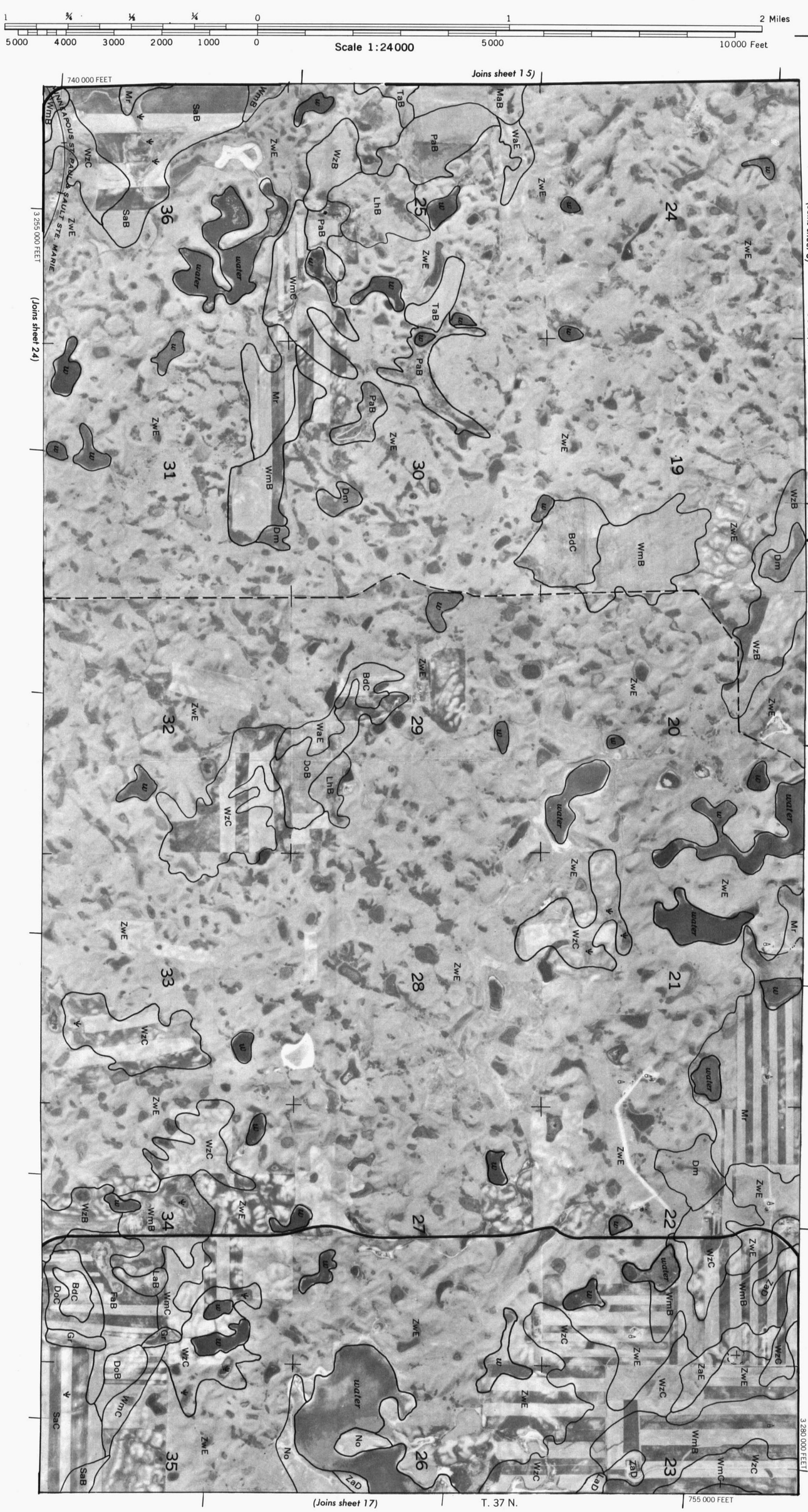
2 Miles

10000 Feet

Scale 1:24000

SHERIDAN COUNTY, MONTANA NO. 15

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SHERIDAN COUNTY, MONTANA — SHEET NUMBER 16

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 16

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 17

17

N

R. 57 E. R. 58 E.

3 285 000 FEET

755 000 FEET

T. 37 N.

(Joins sheet 9)

(Joins sheet 16)

3 305 000 FEET (Joins sheet 25)

745 000 FEET

Flat Lake

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

SHERIDAN COUNTY, MONTANA NO. 17

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NORTH DAKOTA

COUNTY

DIVIDE

SURVEY

SOIL

LIMIT

18

N

2 Miles 10000 Feet

1 5000

Scale 1:24000

¼ 0 0 ¼ 1000 2000 ¼ 3000 4000 ¾ 5000 1

(Joins sheet 10)

R. 51 E. | R. 52 E.

3 105 000 FEET

730 000 FEET

(Joins inset B, sheet 26)

T. 36 N.

715 000 FEET

(Joins sheet 19)

(Joins sheet 27)

3 085 000 FEET

Whitetail

Big Creek

Muddy Creek

Minneapolis, St. Paul and Sault Ste. Marie

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

WmB ZaE ZaD WzC LbF LcF LaC LaD LaE No Ha Bw SaA SaC FaA FaB FaC Fa Uf TuB TaB WaE ZwE BdC DoB ChB ChC SaB Hb

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land div sion corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 18

SHERIDAN COUNTY, MONTANA NO. 19

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 110 000 FEET

730 000 FEET

R. 52 E. | R. 53 E.

(Joins sheet 11)

T. 36 N.

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 28)

3 135 000 FEET

715 000 FEET

Outlook

MINNEAPOLIS ST. PAUL AND SAULT STE. MARIE

N

2 Miles

10000 Feet

Scale 1:24000

20

N

(Joins sheet 12)

R. 53 E.

R. 54 E.

3 165 000 FEET

730 000 FEET

T. 36 N.

(Joins sheet 19)

(Joins sheet 21)

715 000 FEET

3 140 000 FEET

(Joins sheet 29)

Scale 1:24000

2 Miles 10000 Feet 5000

1 0 1 0 1

¼ ½ ¾

1000 2000 3000 4000 5000

Plentywood

MINNEAPOLIS ST. PAUL

STE. MARIE SAULT

Hartis Creek

This map is compiled on 1567 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 20

N

3 170 000 FEET

R. 54 E. | R. 55 E.

(Joins sheet 13)

730 000 FEET

T. 36 N.

(Joins sheet 20)

(Joins sheet 22)

720 000 FEET

(Joins sheet 30)

3 195 000 FEET

Harrys Creek

MINNEAPOLIS ST. PAUL AND SAULT STE. MARIE

McCoy Creek

Raymond

256

2 Miles

10000 Feet

Scale 1:24000

SHERIDAN COUNTY, MONTANA NO. 21

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

(Joins sheet 14)

R. 55 E. R. 56 E.

3 220 000 FEET

735 000 FEET

T. 36 N.

(Joins sheet 21)

(Joins sheet 23)

3 200 000 FEET

720 000 FEET

(Joins sheet 31)

2 Miles 10000 Feet 5000

Scale 1:24000

1 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

BoB TuB WzC ZwE WzB BoA ZaD Dm WaE ZaE WmB FaA Gr SaB BdC DoB DoC FaB Nh LhB w water

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

ST. PAUL AND SAULT STE. MARIE MINNEAPOLIS

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 22

SHERIDAN COUNTY, MONTANA NO. 23

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 225 000 FEET

735 000 FEET

R. 56 E.

R. 57 E.

(Joins sheet 15)

T. 36 N.

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 32)

3 250 000 FEET

725 000 FEET

MINNEAPOLIS ST. RAUL AND SAULT STE. MARIE

Dooley

N

2 Miles

10000 Feet

5000

0

Scale 1:24000

1 1/4 1/2 3/4 1 0 1000 2000 3000 4000 5000

24

N

(Joins sheet 16)

R. 57 E.

R. 58 E.

3 280 000 FEET

740 000 FEET

T. 36 N.

(Joins sheet 23)

(Joins sheet 25)

3 255 000 FEET

(Joins sheet 33)

725 000 FEET

Comertown

MINNEAPOLIS

ST. PAUL

AND

SAULT

STE. MARIE

2 Miles

10000 Feet

Scale 1:24000

5000

1000

2000

3000

4000

5000

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately published.

SHERIDAN COUNTY, MONTANA NO. 24

SHERIDAN COUNTY, MONTANA NO. 25

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

25

N

3 285 000 FEET

740 000 FEET

(Joins sheet 17)

(Joins sheet 24)

(Joins sheet 34)

3 310 000 FEET

730 000 FEET

T. 36 N.

McElroy

Westby

MINNEAPOLIS, ST. PAUL AND SAULT STE. MARIE

Flat Lake

water

SURVEY

DIVIDE

COUNTY

NORTH DAKOTA

SOIL

OF

LIMIT

2 Miles

10000 Feet

Scale 1:24000

5000

(26)

N

2 Miles 1 0 10000 Feet

1 0 5000

Scale 1:24000

1 0 1/4 0 1000 1/2 2000 3/4 3000 4/4 4000 5000

INSET C

3 075 000 FEET (Joins inset A, lower right) R. 51 E.

690 000 FEET

T. 35 N.

COUNTY

DANIELS

(Joins sheet 35)

675 000 FEET

(Joins inset, sheet 68) 3 080 000 FEET

INSET B

R. 51 E. 3 075 000 FEET (Joins inset, sheet 1)

725 000 FEET

T. 36 N.

(Joins sheet 18)

715 000 FEET

(Joins upper right) 3 080 000 FEET

(Joins lower left) R. 51 E. 3 080 000 FEET

710 000 FEET

(Joins sheet 27)

T. 35 N. | T. 36 N.

695 000 FEET

3 075 000 FEET (Joins inset, C upper left)

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 26

SHERIDAN COUNTY, MONTANA NO. 27

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 51 E. | R. 52 E.

3 085 000 FEET

710 000 FEET

T. 35 N. | T. 36 N.

(Joins sheet 26)

(Joins sheet 18)

(Joins sheet 28)

(Joins sheet 35)

3 110 000 FEET

695 000 FEET

Redstone

Muddy Creek

Big Muddy Creek

North Fork Middle Creek

NORTHERN PACIFIC RAILWAY

BURLINGTON NORTHERN

N

2 Miles

10000 Feet

Scale 1:24000

N

R. 52 E. | R. 53 E.

(Joins sheet 19)

3 135 000 FEET

705 000 FEET

(Joins sheet 27)

(Joins sheet 29)

695 000 FEET

(Joins sheet 36) | 3 115 000 FEET

T. 35 N. | T. 36 N.

Scale 1:24 000

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

Plentywood Creek

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 28

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 29

29

SHERIDAN COUNTY, MONTANA NO. 29

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 140 000 FEET

R. 53 E. | R. 54 E.

(Joins sheet 20)

705 000 FEET

T. 36 N.

T. 35 N.

(Joins sheet 28)

(Joins sheet 30)

695 000 FEET

(Joins sheet 37)

3 165 000 FEET

Plentywood

Creek

N

2 Miles

10000 Feet

Scale 1:24000

30

N

(Joins sheet 21)

R. 54 E. | R. 55 E.

3 195 000 FEET

715 000 FEET

(Joins sheet 29)

695 000 FEET

3 170 000 FEET

(Joins sheet 38)

(Joins sheet 31)

T. 35 N. | T. 36 N.

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

1 ¼ ½ ¾ 0 ¼ ½ ¾

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 30

SHERIDAN COUNTY, MONTANA NO. 31

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 55 E. | R. 56 E.

3 200 000 FEET

715 000 FEET

T. 36 N.

T. 35 N.

(Joins sheet 22)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 39)

3 225 000 FEET

705 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

5000 4000 3000 2000 1000 0 0 1000 2000 3000 4000 5000 1

21 22 23 24 19 20
28 27 26 25 30 29
33 34 35 36 31 32
4 3 2 1 6 5

Elder Creek
Box Elder Creek
Morron Creek
water

32

N

R. 56 E. | R. 57 E.

3 225 000 FEET

720 000 FEET

(Joins sheet 23)

(Joins sheet 31)

(Joins sheet 33)

T. 35 N. | T. 36 N.

705 000 FEET

3 230 000 FEET

(Joins sheet 40)

2 Miles

10000 Feet

Scale 1:24000

1 0 1 0

5000 1000 2000 3000 4000 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MONTANA NO. 32

SHERIDAN COUNTY, MONTANA

SHERIDAN COUNTY, MONTANA NO. 33

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 255 000 FEET

720 000 FEET

R. 57 E. | R. 58 E.

(Joins sheet 24)

T. 36 N.

T. 35 N.

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 41)

3 280 000 FEET

705 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

34

N

(Joins sheet 25)

R. 58 E.

3 310 000 FEET

725 000 FEET

(Joins sheet 33)

705 000 FEET

3 285 000 FEET

(Joins sheet 42)

2 Miles

10000 Feet

Scale 1:24000

DAKOTA SURVEY

NORTH DIVISION OF SOIL LIMIT

T. 35 N. | T. 36 N

COUNTY

Goose Lake

Goose Lake

Memory (outlined)

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 34

SHERIDAN COUNTY, MONTANA NO. 35

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

2 Miles
10000 Feet

Scale 1:24000

1 0 1
¾ ¾ ¾
5000 4000 3000 2000 1000 0 0
5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 37

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 145 000 FEET

695 000 FEET

R. 53 E. | R. 54 E.

(Joins sheet 29)

T. 35 N.

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 45)

3 170 000 FEET

680 000 FEET

N

Scale 1:24000

2 Miles

10000 Feet

5000

1

5000 4000 3000 2000 1000 0 0 1000 2000 3000 4000 5000

N

2 Miles

10000 Feet

Scale 1:24000

1 5000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1¼ 5000

R. 54 E. | R. 55 E.

3 195 000 FEET

695 000 FEET

T. 35 N.

380 000 FEET

3 175 000 FEET

(Joins sheet 30)

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 46)

BURLINGTON NORTHERN

PLENTYWOOD

Reservoir

Big Muddy Creek

McCoy Creek

Box Elder Creek

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 38

SHERIDAN COUNTY, MONTANA NO. 39

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 200 000 FEET

R. 55 E.

R. 56 E.

(Joins sheet 31)

695 000 FEET

T 35 N.

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 47)

3 225 000 FEET

685 000 FEET

N

2 Miles

10000 Feet

5000

1

Scale 1:24000

0 1000 2000 3000 4000 5000

(40)

N

(Joins sheet 32)

R. 56 E. | R. 57 E

3 255 000 FEET

700 000 FEET

T. 35 N.

(Joins sheet 39)

685 000 FEET

3 230 000 FEET

(Joins sheet 48)

(Joins sheet 41)

2 Miles

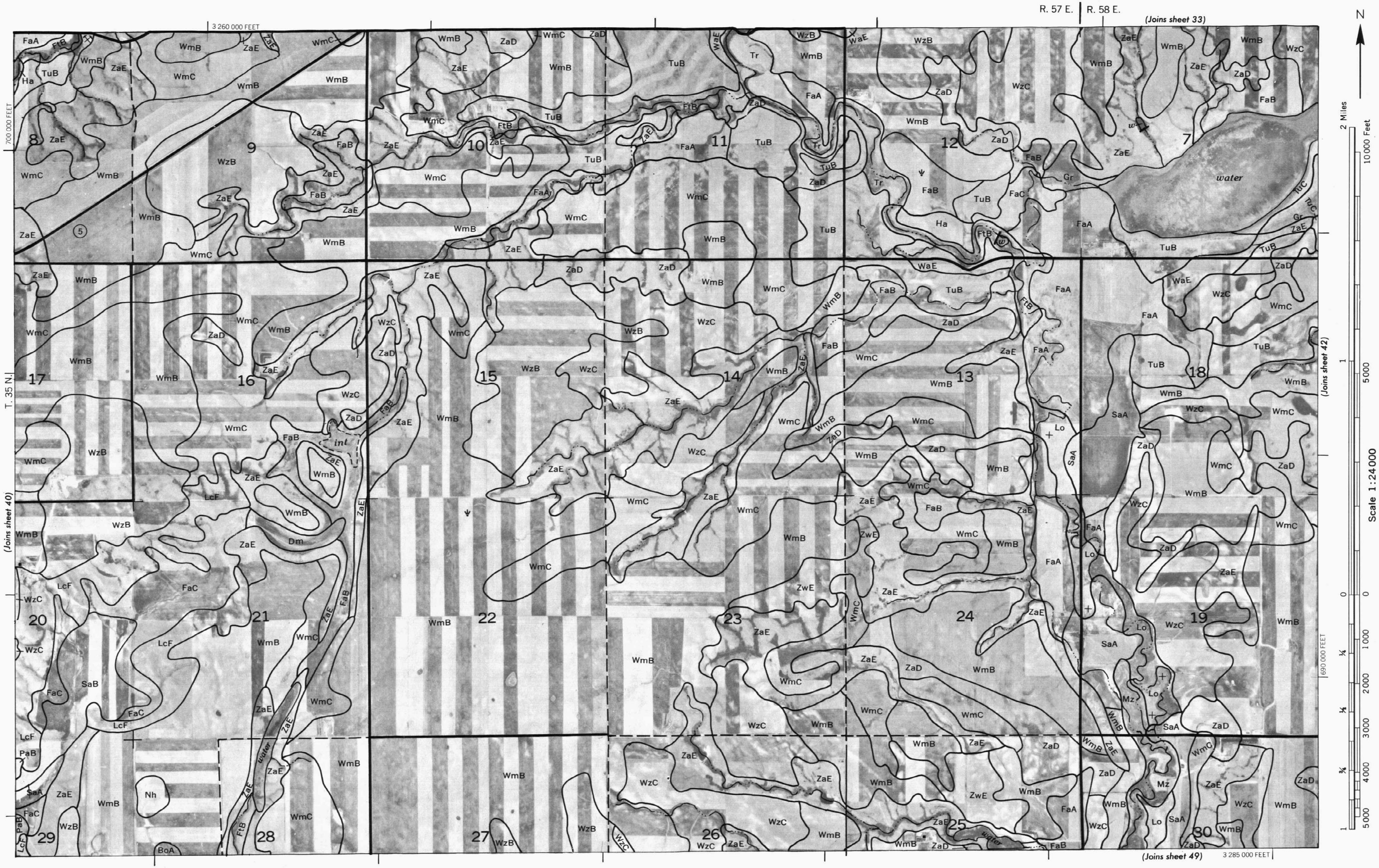
10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 40



SHERIDAN COUNTY, MONTANA NO. 41

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

42

N

2 Miles

10000 Feet

1 5000

Scale 1:24000

(Joins sheet 34)

R. 58 E.

3 310 000 FEET

705 000 FEET

T. 35 N.

DIVIDE COUNTY

NORTH DAKOTA

SOIL SURVEY OF SHERIDAN COUNTY, MONTANA NO. 42

690 000 FEET

3 290 000 FEET

(Joins sheet 41)

(Joins sheet 50)

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 43

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 085 000 FEET

R. 51 E. | R. 52 E.

(Joins sheet 35)

670 000 FEET

T. 35 N.

T. 34 N.

(Joins inset, sheet 68)

(Joins sheet 44)

(Joins sheet 52)

3 110 000 FEET

660 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

1 0 ½ 1000 2000 3000 4000 5000

N

R. 52 E. | R. 53 E.

(Joins sheet 36)

(Joins sheet 43)

(Joins sheet 53)

(Joins sheet 45)

3 140 000 FEET

675 000 FEET

660 000 FEET

3 115 000 FEET

T. 34 N. | T. 35 N.

2 Miles

10000 Feet

5000

1

Scale 1:24000

0 1000 2000 3000 4000 5000

¼ ¾ ¼ ¾

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 45

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 53 E. | R. 54 E.

T. 34 N. | T. 35 N.

3 145 000 FEET

675 000 FEET

660 000 FEET

3 170 000 FEET

(Joins sheet 37)

(Joins sheet 44)

(Joins sheet 46)

(Joins sheet 54)

N

2 Miles

10 000 Feet

Scale 1:24000

5000

Big Creek

Muddy Creek

Horse Creek

Crazy

27 26 25 30 29 28
34 35 36 31 32 33
3 2 1 6 5 4
10 11 12 7 8 9

Ha LcF ChB SaB WmB LaC LbF WzC WzB ZaE ZaD BoA FaB FaC Uf No Hb LaD FtB TuB ZwE

46

N

(Joins sheet 38)

R. 54 E. | R. 55 E.

3 195 000 FEET

680 000 FEET

T. 34 N. | T. 35 N.

(Joins sheet 45)

(Joins sheet 47)

3 175 000 FEET

660 000 FEET

(Joins sheet 55)

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

Big Muddy Creek

Lonetree Coulee

Shippe Coulee

This map was compiled on 1567 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 46

SHERIDAN COUNTY, MONTANA NO. 47

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 200 000 FEET

680 000 FEET

R. 55 E. | R. 56 E.

(Joins sheet 39)

T. 35 N. | T. 34 N.

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 56)

3 225 000 FEET

665 000 FEET

BURLINGTON NORTHERN

Big Muddy Creek

Scale 1:24000

2 Miles 10000 Feet

N

(Joins sheet 40)

R. 56 E. | R. 57 E.

3 255 000 FEET

(Joins sheet 47)

T. 35 N.

T. 34 N.

680 000 FEET

655 000 FEET

(Joins sheet 49)

3 230 000 FEET

(Joins sheet 57)

Antelope Creek

Scale 1:24 000

2 Miles 1 0 1

10000 Feet 5000 0

1 ¼ ½ ¾ 1

1 000 2 000 3 000 4 000 5 000

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 48

SHERIDAN COUNTY, MONTANA NO. 49

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 57 E. | R. 58 E.

(Joins sheet 41)

3 260 000 FEET

680 000 FEET

T. 35 N.

T. 34 N.

(Joins sheet 48)

(Joins sheet 50)

670 000 FEET

(Joins sheet 58)

3 285 000 FEET

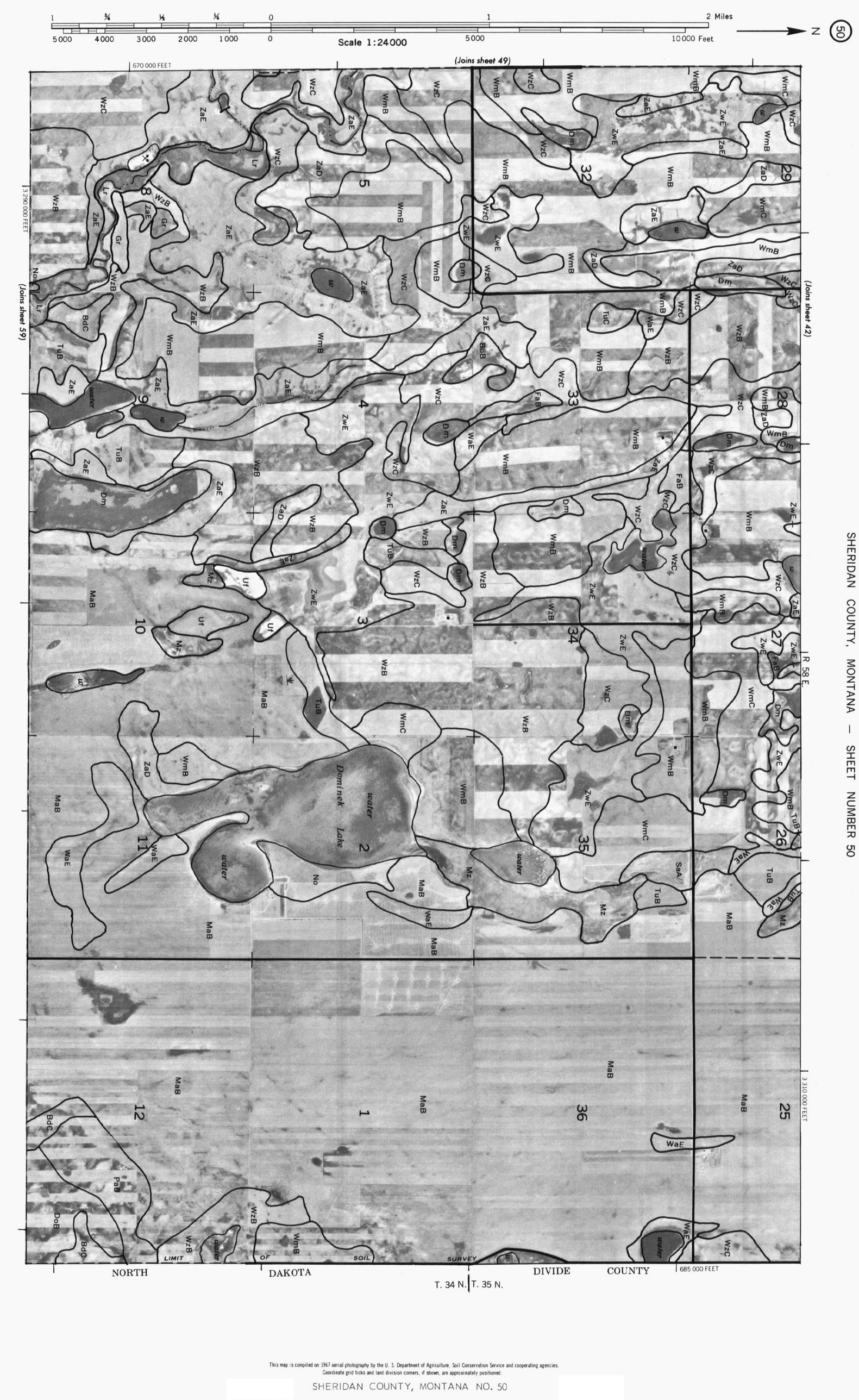
49

N

2 Miles

10000 Feet

Scale 1:24000



SHERIDAN COUNTY, MONTANA — SHEET NUMBER 50

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 50

N

SHERIDAN COUNTY, MONTANA NO. 51

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 055 000 FEET

650 000 FEET

R. 51 E.

(Joins inset, sheet 68)

3 077 000 FEET

R. 51 E.

(Joins lower right)

DANIELS COUNTY

638 000 FEET

SURVEY

SOIL

OF

LIMIT

T. 34 N.

WzC LcF ZaD WzC WmB FaB WzC LcF LaD TuB WzC 34 35 WzB LcF WzC WzB WzC LcF

(Joins sheet 60)

635 000 FEET

DANIELS COUNTY

3 083 000 FEET

WzB FaB WzC WzC LaD LcF w FaB 15 14 LaD Mz FaA FaA FaB LaD

650 000 FEET

SURVEY

T. 34 N.

WzB FaB FaA LaD Mz FaB 22 23 LaC WzC TuB LaC LaD Mz LaD WmB ZaD FtB FaB LaD ChC LaD FtB ChC LaD ChC Mz LcF 27 26 WzC LaD WzC LcF ZaD WzC WmB

(Joins sheet 52)

COUNTY

DANIELS

SOIL

OF

LIMIT

640 000 FEET

3 080 000 FEET

(Joins upper left)

2 Miles

10000 Feet

1

5000

0

Scale 1:24000

¼ ½ ¾ 1

1000 2000 3000 4000 5000

52

N

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

(Joins sheet 43)

R. 51 E. | R. 52 E.

3 110 000 FEET

655 000 FEET

T. 34 N.

(Joins sheet 53)

640 000 FEET

3 085 000 FEET

(Joins sheet 60)

(Joins sheet 51)

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

water

Wolf Creek

LaD LaC FaB TuB WmB WbE WzC ZaE ZaD LcF WzB DoB DoC Dm TuC WaE LbF Nh FtB ChC Mz

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 52

SHERIDAN COUNTY, MONTANA NO. 53

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

53

N

R. 52 E. R. 53 E.

3 115 000 FEET

655 000 FEET

T. 34 N.

(Joins sheet 44)

(Joins sheet 52)

(Joins sheet 54)

(Joins sheet 61)

645 000 FEET

3 140 000 FEET

2 Miles

10000 Feet

5000

Scale 1:24000

54

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 54

N

2 Miles

10000 Feet

1 5000

Scale 1:24000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1¼ 5000

(Joins sheet 45)

(Joins sheet 53)

R. 53 E. | R. 54 E.

3 170 000 FEET

660 000 FEET

645 000 FEET

3 145 000 FEET

(Joins sheet 62)

(Joins sheet 55)

T. 34 N.

Creek

Horse

Crazy

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 54

SHERIDAN COUNTY, MONTANA NO. 55

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

55

N

3 175 000 FEET

660 000 FEET

R. 54 E. | R. 55 E.

(Joins sheet 46)

T. 34 N.

(Joins sheet 54)

(Joins sheet 56)

650 000 FEET

(Joins sheet 63)

3 200 000 FEET

2 Miles

10000 Feet

Scale 1:24000

5000

0

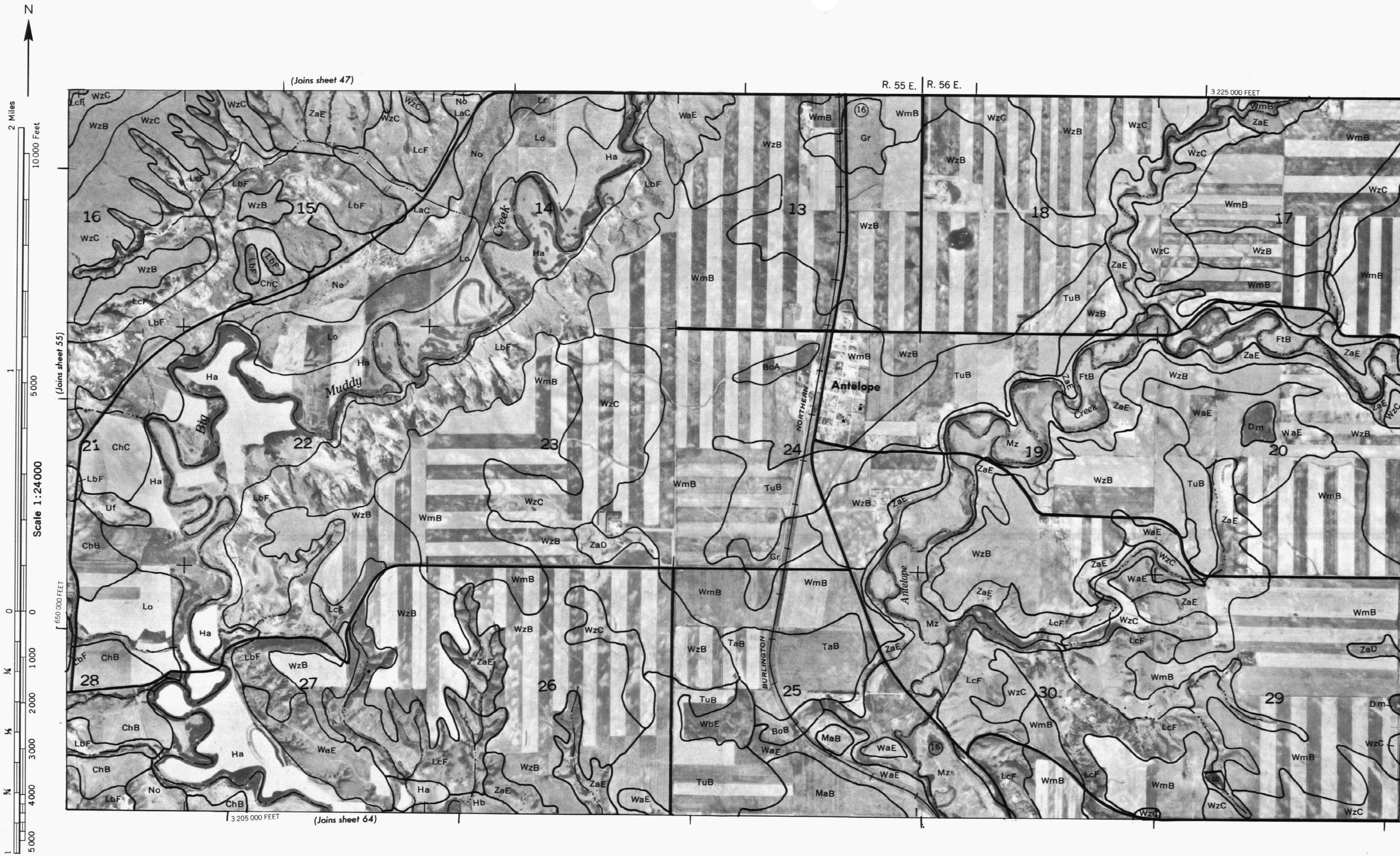
1000

2000

3000

4000

5000



This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 56

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 57

57

N

R. 56 E. | R. 57 E.

(Joins sheet 48)

3 230 000 FEET

560 000 FEET

T. 34 N.

(Joins sheet 56)

(Joins sheet 58)

(Joins sheet 65)

3 255 000 FEET

650 000 FEET

Antelope Creek

Scale 1:24000

2 Miles

10000 Feet

SHERIDAN COUNTY, MONTANA NO. 57

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

58

N

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

Scale 1:24000

(Joins sheet 49)

(Joins sheet 57)

(Joins sheet 66)

(Joins sheet 59)

R. 57 E. | R. 58 E.

T. 34 N.

3 285 000 FEET

665 000 FEET

650 000 FEET

3 260 000 FEET

Coalridge

water

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 58

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 59

59

SHERIDAN COUNTY, MONTANA NO. 59

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 290 000 FEET

665 000 FEET

R. 58 E.

(Joins sheet 50)

T. 34 N.

(Joins sheet 58)

(Joins sheet 67)

3 315 000 FEET

655 000 FEET

N

NORTH

SOIL SURVEY

DAKOTA COUNTY

DIVIDE COUNTY

LIMIT OF

2 Miles

10000 Feet

Scale 1:24000

5000 4000 3000 2000 1000 0 0 ¼ ½ ¾ 1

20 21 22 23 24

17 16 15 14 13

29 28 27 26 25

WmB ZaE ZaD TuB SaA BoA FaA WzC WzB TuB Lr No MaB Dm SaA WaE DoB DoC BdC PaB ZwE DoB DoC WmB WzC TaB int water Mr w

N

2 Miles

10000 Feet

Scale 1:24000

(Joins sheet 52) R. 51 E. R. 52 E.

3 110 000 FEET

640 000 FEET

T. 34 N.

T. 33 N.

(Joins inset, sheet 51)

LIMIT OF SOIL SURVEY

DANIELS COUNTY

SURVEY

SOIL

LIMIT OF

DANIELS

COUNTY

FORT PECK INDIAN RESERVATION

Wolf Creek

35 36 31 32 33 34

6 5 4 3

7 8 9 10

18 17 16 15

WmB FaB TuB WzC Mz Sh LcF ZaD FtB LaD ZwE FaA WzB ZaE Uf FaC WbE

620 000 FEET

3 090 000 FEET

(Joins sheet 68)

(Joins sheet 61)

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 60

SHERIDAN COUNTY, MONTANA NO. 61

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 52 E. | R. 53 E.

3 115 000 FEET

640 000 FEET

T. 34 N.

T. 33 N.

(Joins sheet 53)

(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 69)

3 140 000 FEET

625 000 FEET

FORT PECK INDIAN RESERVATION

Wolf Creek

N

2 Miles

10000 Feet

Scale 1:24000

N

R. 53 E. | R. 54 E.

3 170 000 FEET

640 000 FEET

T. 33 N. | T. 34 N.

(Joins sheet 54)

(Joins sheet 61)

(Joins sheet 63)

(Joins sheet 70)

3 145 000 FEET

625 000 FEET

FORT PECK INDIAN RESERVATION

Scale 1:24000

2 Miles 10000 Feet 5000 0 1000 2000 3000 4000 5000

1 1/4 1/4 1/4 1

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 62

SHERIDAN COUNTY, MONTANA NO. 63

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

63

N

3 175 000 FEET

640 000 FEET

R. 54 E. | R. 55 E.

T. 34 N.

T. 33 N.

(Joins sheet 55)

(Joins sheet 64)

(Joins sheet 62)

(Joins sheet 71)

3 200 000 FEET

630 000 FEET

FORT PECK INDIAN RESERVATION

Otter Creek

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 5000 1/4 1000 1/2 2000 3/4 3000 4/4 4000

64

N

R. 55 E. | R. 56 E.

(Joins sheet 56)

3 230 000 FEET

645 000 FEET

T. 34 N.

T. 33 N.

(Joins sheet 63)

630 000 FEET

3 205 000 FEET

(Joins sheet 72)

(Joins sheet 65)

2 Miles

10 000 Feet

Scale 1:24000

1 0 1 2 3 4 5 Miles

5000 0 1000 2000 3000 4000 5000 Feet

Big Muddy Creek

Antelope Creek

NORTHERN BURLINGTON

FORT PECK INDIAN RESERVATION

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 64

SHERIDAN COUNTY, MONTANA NO. 65

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

65

N

3 235 000 FEET

R. 56 E. | R. 57 E.

(Joins sheet 57)

645 000 FEET

T. 34 N. | T. 33 N.

(Joins sheet 64)

(Joins sheet 66)

(Joins sheet 73)

3 260 000 FEET

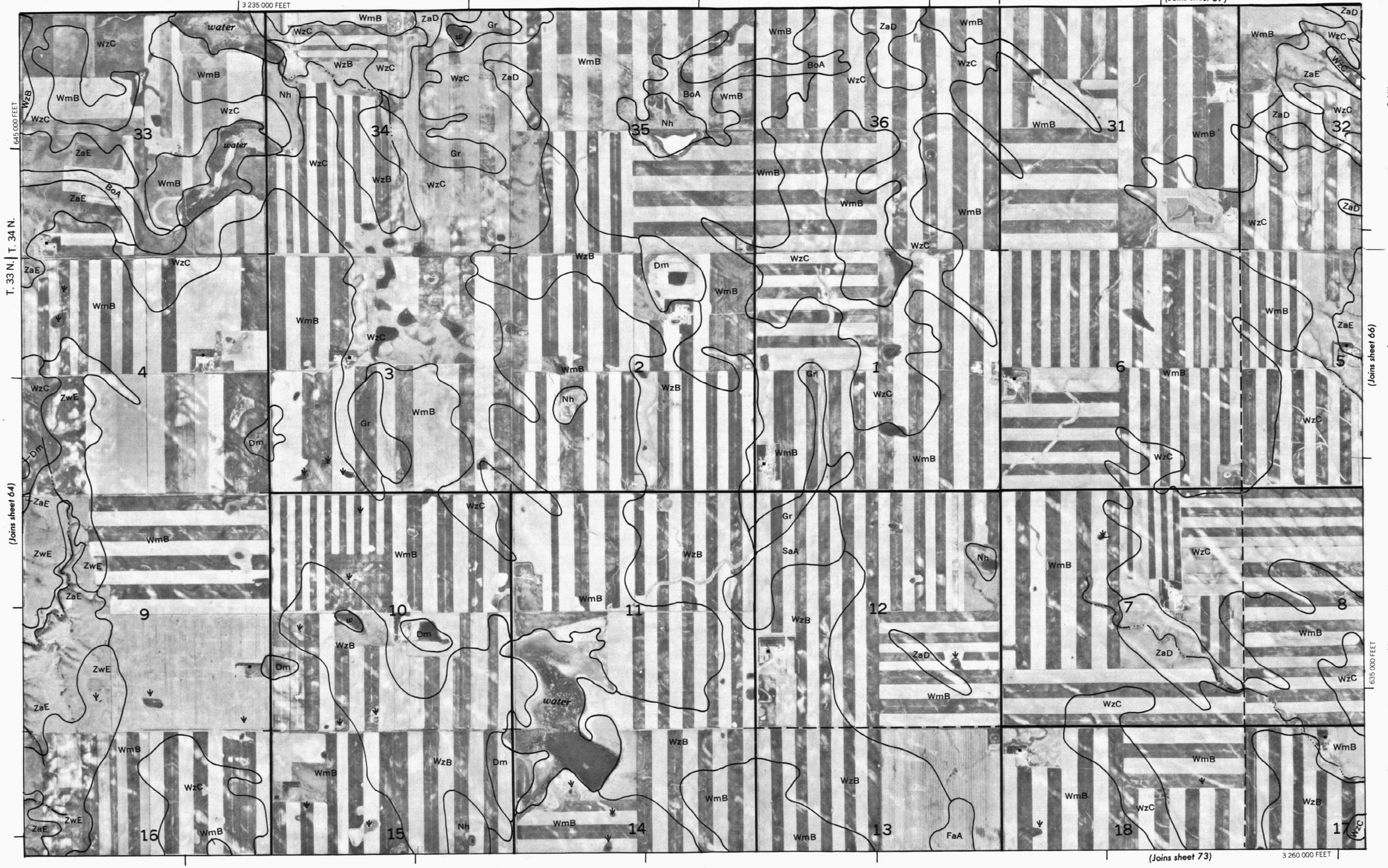
635 000 FEET

2 Miles

10000 Feet

5000

Scale 1:24000



N

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0 5000

(Joins sheet 58)

(Joins sheet 65)

(Joins sheet 67)

(Joins sheet 74)

R. 57 E. | R. 58 E.

T. 34 N.

T. 33 N.

3 285 000 FEET

650 000 FEET

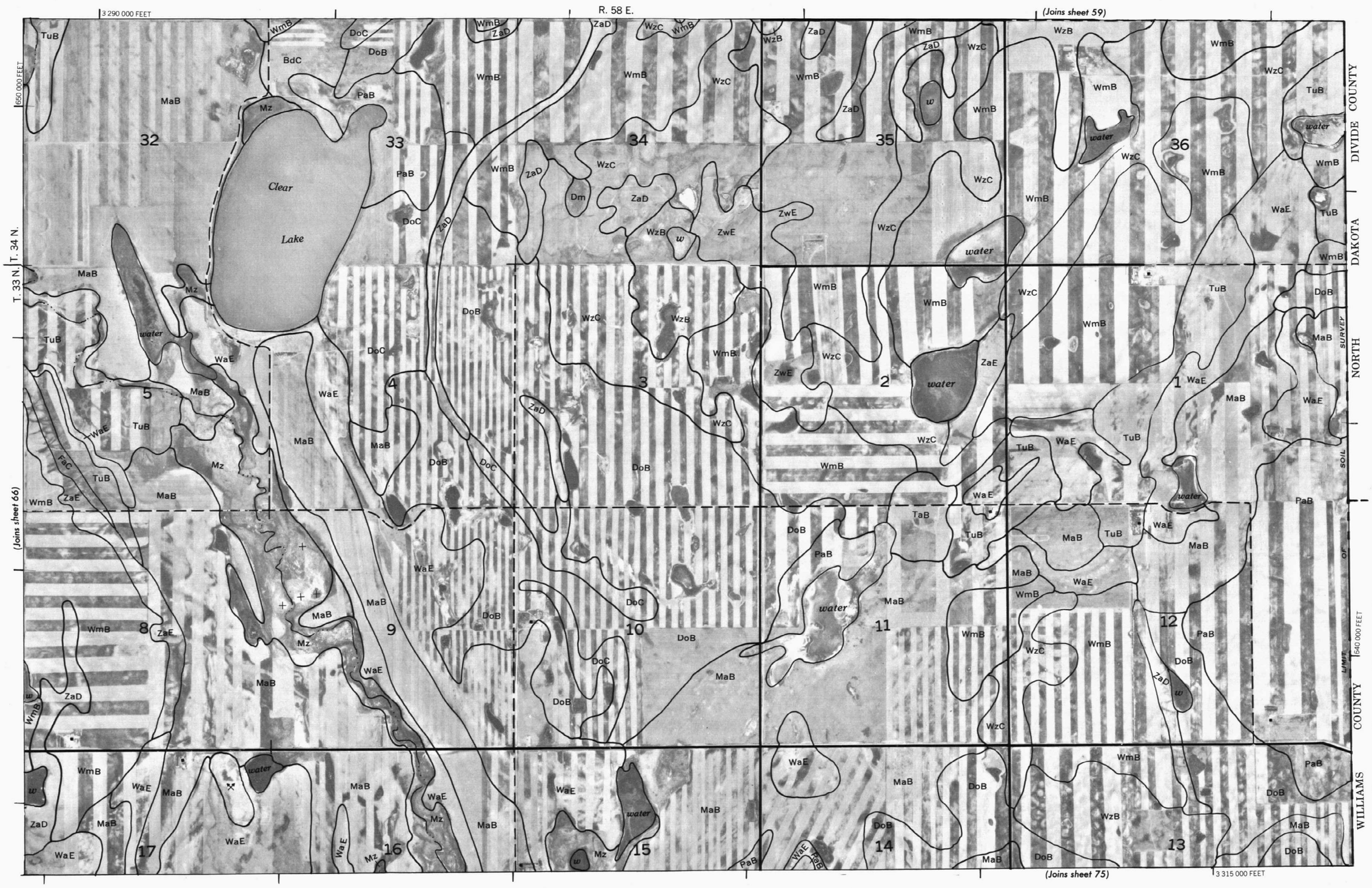
635 000 FEET

3 265 000 FEET

SHERIDAN COUNTY, MONTANA NO. 66

SHERIDAN COUNTY, MONTANA NO. 67

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



67

N

2 Miles

10000 Feet

Scale 1:24000

1 5000 0 0

1 5000 1000

¾ 4000 2000

½ 3000 ½

¼ 2000 ¼

0 1000 0

INSET A

N

Scale 1:24000

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

3 077 000 FEET

670 000 FEET

R. 51 E. *(Joins inset, C sheet 26)*

(Joins sheet 60)

R. 52 E.

3 115 000 FEET

620 000 FEET

T. 35 N.

T. 34 N.

T. 33 N.

(Joins sheet 43)

(Joins sheet 69)

DANIELS COUNTY

SOIL SURVEY OF DANIELS COUNTY, MONTANA NO. 68

FORT PECK INDIAN RESERVATION

605 000 FEET

655 000 FEET

3 083 000 FEET

3 095 000 FEET

(Joins sheet 51)

ROOSEVELT COUNTY

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 69

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

3 120 000 FEET

620 000 FEET

R. 52 E. | R. 53 E.

(Joins sheet 61)

T. 33 N.

(Joins sheet 68)

FORT PECK INDIAN RESERVATION

Wolf Creek

(Joins sheet 70)

610 000 FEET

3 145 000 FEET

ROOSEVELT COUNTY

LIMIT OF SOIL SURVEY

N

2 Miles

10000 Feet

Scale 1:24000

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 70

70

N

(Joins sheet 62)

R. 53 E. | R. 54 E.

3 170 000 FEET

625 000 FEET

(Joins sheet 69)

T. 33 N.

(Joins sheet 71)

610 000 FEET

Joins sheet 76)

3 150 000 FEET

FORT PECK INDIAN RESERVATION

Wolf Creek

Scale 1:24000

2 Miles 10000 Feet

1 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 70

SHERIDAN COUNTY, MONTANA NO. 71

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 175 000 FEET

625 000 FEET

R. 54 E. | R. 55 E.

(Joins sheet 63)

T. 33 N.

(Joins sheet 70)

(Joins sheet 72)

(Joins sheet 77)

3 200 000 FEET

610 000 FEET

FORT PECK INDIAN RESERVATION

Otter Creek

water

N

Scale 1:24000

2 Miles 1 0 10000 Feet 5000 0

1 ¼ ½ ¾ 1 5000 1000 2000 3000 4000 5000

72

N

(Joins sheet 64)

R. 55 E. | R. 56 E.

3 230 000 FEET

625 000 FEET

T. 33 N.

(Joins sheet 73)

(Joins sheet 71)

610 000 FEET

3 205 000 FEET

(Joins sheet 78)

FORT PECK INDIAN RESERVATION

Otter Creek

Muddy Creek

Big Muddy Creek

NORTHERN

BURLINGTON

2 Miles

10 000 Feet

5 000

1

Scale 1:24 000

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 72

SHERIDAN COUNTY, MONTANA NO. 73

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 235 000 FEET

R. 56 E.

R. 57 E.

(Joins sheet 65)

1625 000 FEET

T. 33 N.

(Joins sheet 72)

(Joins sheet 74)

(Joins sheet 79)

3 260 000 FEET

615 000 FEET

Eden Valley School

N

2 Miles

10000 Feet

5000

1

Scale 1:24000

0

1/4

1/2

3/4

1

1000

2000

3000

4000

5000

74

N

R. 57 E. | R. 58 E.

3 285 000 FEET

(Joins sheet 66)

(Joins sheet 73)

(Joins sheet 75)

(Joins sheet 80)

615 000 FEET

630 000 FEET

T. 33 N.

Hiawatha School

Dagmar

water

2 Miles 1 0 1

10 000 Feet 5 000 0 5 000

Scale 1:24000

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 74

SHERIDAN COUNTY, MONTANA NO. 75

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 290 000 FEET

630 000 FEET

R. 58 E.

(Joins sheet 67)

T. 33 N.

(Joins sheet 74)

(Joins sheet 81)

3 315 000 FEET

620 000 FEET

Brush Lake

Long Lake

Horseshoe Lake

water

Wilson School

DAKOTA NORTH SOIL SURVEY OF WILLIAMS COUNTY

75

N

2 Miles

10000 Feet

Scale 1:24000

N

(Joins sheet 70)

R. 54 E.

3 175 000 FEET

605 000 FEET

T. 32 N.

(Joins sheet 77)

590 000 FEET

3 150 000 FEET

(Joins sheet 82)

COUNTY

ROOSEVELT

FORT PECK INDIAN RESERVATION

SURVEY

LIMIT

Wolf Creek

Scale 1:24000

2 Miles

10000 Feet

1 5000

0 0

1000 2000 3000 4000 5000

SHERIDAN COUNTY, MONTANA NO. 76

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

77

SHERIDAN COUNTY, MONTANA NO. 77

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 54 E. | R. 55 E. | 3 180 000 FEET

605 000 FEET

T. 32 N.

(Joins sheet 71)

(Joins sheet 76)

(Joins sheet 78)

(Joins sheet 83)

595 000 FEET

3 205 000 FEET

FORT PECK INDIAN RESERVATION

Wolf Creek

Big Muddy Creek

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 5000 1 000

¼ 2000

½ 3000

¾ 4000

1 5000

78

N

R. 55 E. | R. 56 E.

(Joins sheet 72)

3 230 000 FEET

610 000 FEET

FORT PECK INDIAN RESERVATION

Muddy Creek

NORTHERN

Big Muddy

BURLINGTON

(Joins sheet 77)

(Joins sheet 79)

(Joins sheet 94)

3 210 000 FEET

595 000 FEET

T. 32 N.

Scale 1:24000

2 Miles 0 10000 Feet

1 5000 0

1/4 1/2 3/4 1 1000 2000 3000 4000 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 78

SHERIDAN COUNTY, MONTANA NO. 79

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3 235 000 FEET

610 000 FEET

R. 56 E. R. 57 E.

(Joins sheet 73)

T. 32 N.

(Joins sheet 78)

(Joins sheet 80)

(Joins sheet 85)

3 260 000 FEET

595 000 FEET

N

2 Miles

10000 Feet

Scale 1:24000

1 5000

0 0

1/4 1000

1/2 2000

3/4 3000

1 4000

5000

National Wildlife Refuge

Lake Medicine

80

N

2 Miles

10000 Feet

1 5000

Scale 1:24000

0 0

¼ ¼ ¼ ¼

5000 4000 3000 2000 1000

595 000 FEET

3 265 000 FEET

(Joins sheet 74)

R. 57 E. | R. 58 E.

3 290 000 FEET

615 000 FEET

T. 32 N.

(Joins sheet 79)

(Joins sheet 81)

(Joins sheet 86)

Refuge

Wildlife

Migratory

Lake

Medicine

Katy Lake

water

WzB WzC WmB ZaD ZaE FaB Nh TaB TuB ZaE WaE MaB TuC DoB BoB BoA No Mz PaB DoC Tr

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 80

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 81

81

R. 58 E. | R. 59 E.

3 295 000 FEET

615 000 FEET

(Joins sheet 75)

T. 32 N.

(Joins sheet 80)

(Joins sheet 87)

3 320 000 FEET

600 000 FEET

Hans Christian Anderson School

Long Lake

water

Cottonwood Creek

DAKOTA NORTH SOIL SURVEY

WILLIAMS COUNTY, NORTH DAKOTA

N

2 Miles

10000 Feet

Scale 1:24000

SHERIDAN COUNTY, MONTANA NO. 81

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

82

N

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

Scale 1:24000

(Joins sheet 76)

R. 54 E.

3 175 000 FEET

585 000 FEET

T. 32 N.

(Joins sheet 83)

570 000 FEET

3 155 000 FEET

COUNTY

ROOSEVELT

SURVEY

SOIL

LIMIT

OF

FORT PECK INDIAN RESERVATION

ROOSEVELT COUNTY

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

LcF ZwE WzB ZaE FaB WzC WmB Dm Gr water ZaD Nh

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 82

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 83

83

SHERIDAN COUNTY, MONTANA NO. 83

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

R. 54 E. | R. 55 E.

3 180 000 FEET

585 000 FEET

T. 32 N. (Joins sheet 82)

T. 31 N.

(Joins sheet 77)

(Joins sheet 88)

3 205 000 FEET

575 000 FEET

(Joins sheet 84)

LIMIT OF ROOSEVELT COUNTY SOIL SURVEY

INDIAN RESERVATION

FORT PECK

Wolf Creek

Medicine Lake National Wildlife Refuge

Muddy Creek

Big Muddy Creek

Medicine Lake

Creek

Lake

NORTHERN BURLINGTON

N

2 Miles

10000 Feet

Scale 1:24000

84

N

(Joins sheet 78) R. 55 E. | R. 56 E.

3 235 000 FEET

590 000 FEET

Medicine Lake

NORTHERN

BURLINGTON

Medicine Lake Refuge

National Wildlife Refuge

Bruces Island

Youngs No Island

Lake Creek

Medicine Lake

(Joins sheet 83)

(Joins sheet 85)

T. 31 N. | T. 32 N.

575 000 FEET

3 210 000 FEET (Joins sheet 89)

2 Miles 10000 Feet

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 84

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 85

85

N

R. 56 E. | R. 57 E.

3 240 000 FEET

590 000 FEET

(Joins sheet 79)

(Joins sheet 86)

(Joins sheet 84)

(Joins sheet 90)

3 265 000 FEET

580 000 FEET

T. 32 N. | T. 31 N.

Medicine Lake National Wildlife Refuge

Cottonwood Creek

Sand Creek

Capeneys Lake

Medicine Lake

Medicine Lake

water

Scale 1:24000

2 Miles

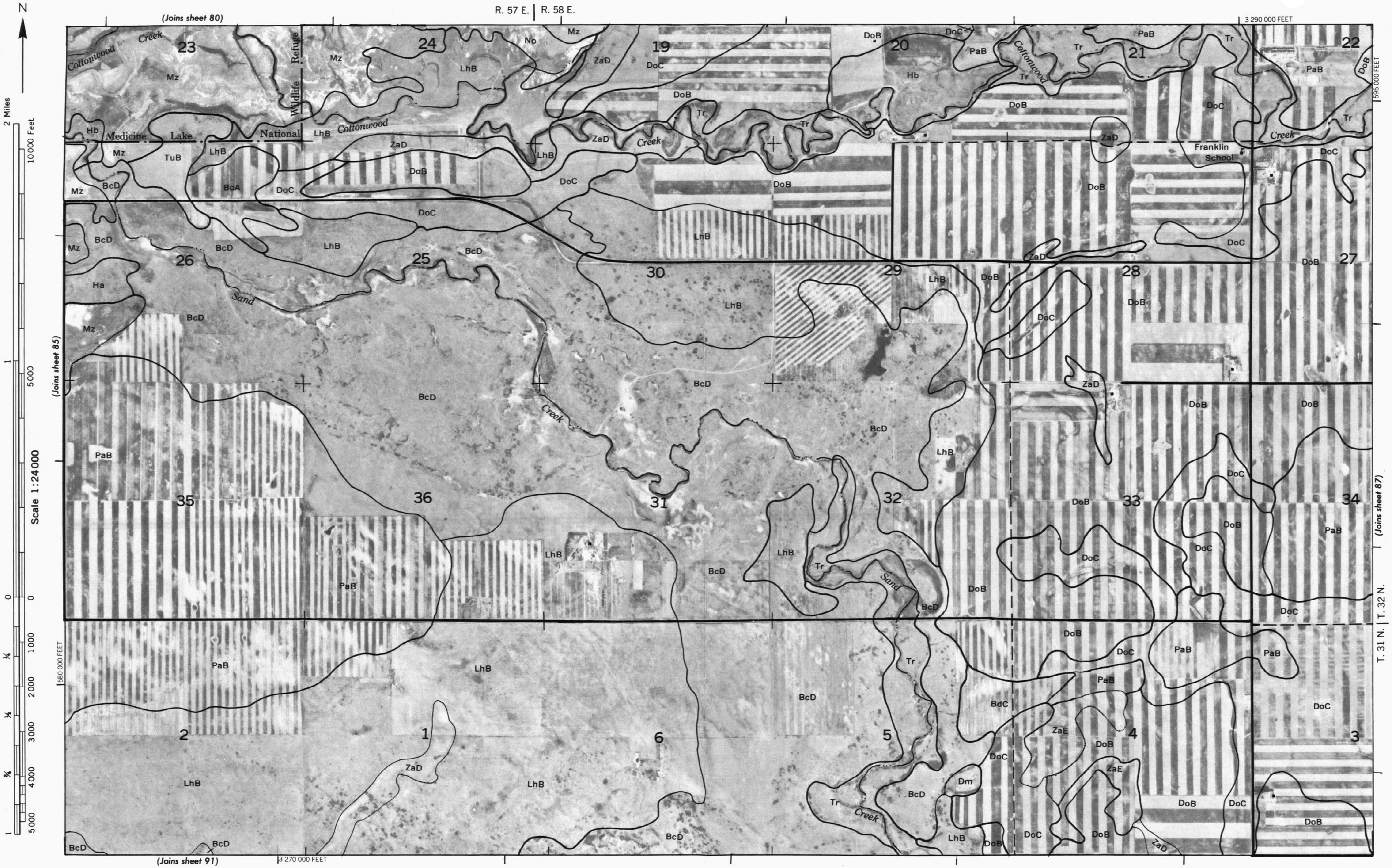
10000 Feet

5000

SHERIDAN COUNTY, MONTANA NO. 85

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 86



This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 87

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

(Joins sheet 83)

R. 55 E.

3 205 000 FEET

570 000 FEET

T. 31 N.

555 000 FEET

3 180 000 FEET

(Joins inset, sheet 93)

(Joins sheet 89)

2 Miles

10000 Feet

Scale 1:24000

1 5000

0 0

½ 1000

½ 2000

¾ 3000

¾ 4000

1 5000

FORT PECK INDIAN RESERVATION

COUNTY SOIL SURVEY

ROOSEVELT OF LIMIT

Creek

Lake

Muddy

Big

NORTHERN

BURLINGTON

Homestead

water

7 8 9 10 11

18 17 16 15 14

19 20 21 22 23

30 29 28 27 26

ZaE Ha WzC WzB WmB Lo Bw Lr No Hb TaB Sh PaB WmC TuB WaE DoC MaB BoA Nh ZaD

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating Agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 88

SHERIDAN COUNTY, MONTANA NO. 89

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

89

N

R. 55 E. | R. 56 E.

3 210 000 FEET

570 000 FEET

T. 31 N.

(Joins sheet 84)

(Joins sheet 88)

(Joins sheet 90)

(Joins sheet 93)

3 235 000 FEET

560 000 FEET

Medicine Lake

Lake

National Wildlife Refuge

2 Miles

10000 Feet

Scale 1:24000

90

N

(Joins sheet 85)

R. 56 E. | R. 57 E.

3 265 000 FEET

575 000 FEET

T. 31 N.

(Joins sheet 91)

(Joins sheet 89)

560 000 FEET

3 240 000 FEET (Joins inset, sheet 94)

Medicine Lake

Big Island

Medicine Lake National Wildlife Refuge

Scale 1:24000

2 Miles 10000 Feet

1 5000 0 0

¼ 1000 ¼ 2000 ¾ 3000 ¾ 4000 1 5000

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

SHERIDAN COUNTY, MONTANA NO. 90

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 91

91

N

R. 57 E. | R. 58 E.

3 270 000 FEET

575 000 FEET

T. 31 N.

(Joins sheet 86)

(Joins sheet 90)

(Joins sheet 92)

(Joins sheet 94)

3 295 000 FEET

560 000 FEET

Creek

Sand Creek

Sunnyhill School

2 Miles

10000 Feet

Scale 1:24000

SHERIDAN COUNTY, MONTANA NO. 91

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

92

N

(Joins sheet 87)

R. 58 E. | R. 59 E.

3 320 000 FEET

580 000 FEET

LIMIT OF SOIL SURVEY

T. 31 N.

NORTH DAKOTA

WILLIAMS COUNTY, MONTANA

2 Miles

10 000 Feet

Scale 1:24000

(Joins sheet 91)

(Joins sheet 95)

560 000 FEET

3 300 000 FEET

10 11 12 9 15 14 13 8 7 18 17 16 22 23 24 19 20 21 27 26 25 30 29 28

DoC DoB ZaD ZaE WmB WmC WzC BdC LhB Tr PaB BcD FaB ChC ZwE FaA

This map is compiled on 1957 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 92

SHERIDAN COUNTY, MONTANA NO. 93

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

93

N

Scale 1:24000

2 Miles 1

10000 Feet 5000 0

0 1000 2000 3000 4000 5000

3 210 000 FEET

R. 55 E.

R. 56 E.

(Joins sheet 89)

(Joins sheet 94)

550 000 FEET

T. 31 N.

(Joins lower right)

25 30 29 28 27 26

36 31 32 33 34 35

16

ZaE WmB WmC BoB BoA Nh Gr WzC Dm WzB LhD

LIMIT OF SOIL SURVEY

ROOSEVELT COUNTY

3 235 000 FEET

(Joins upper left)

(Joins sheet 88)

3 205 000 FEET

545 000 FEET

3 185 000 FEET

FORT PECK INDIAN RESERVATION

Muddy Creek

Big Homestead Lake

BURLINGTON NORTHERN

30 29 28 27 26

31 32 33 34 35

WzB ZaE WzC WmB Bw Lr MaB w LhB LhC PaB DoB DoC Nh BoA

94

N

2 Miles 10000 Feet

1 5000

Scale 1:24000

0 0 1000 2000 3000 4000 5000

R. 57 E. | R. 58 E.

(Joins sheet 91)

3 295 000 FEET

560 000 FEET

T. 31 N.

(Joins lower right)

(Joins sheet 95)

550 000 FEET

3 270 000 FEET

ROOSEVELT COUNTY

LIMIT OF SOIL SURVEY

26 25 30 29 28 27

35 36 31 32 33 34

BcD LhB ZaE DoB DoC ZaD WmB No Tr

Creek

Sand

R. 56 E. | R. 57 E.

(Joins sheet 90)

3 265 000 FEET

550 000 FEET

T. 31 N.

(Joins upper left)

(Joins sheet 93)

3 240 000 FEET

ROOSEVELT COUNTY

LIMIT OF SOIL SURVEY

26 25 30 29 28 27

35 36 31 32 33 34

WmB ZaE WmC DoB DoC LhB PaB WzC ZaD BcD

Beverly School

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SHERIDAN COUNTY, MONTANA NO. 94

SHERIDAN COUNTY, MONTANA — SHEET NUMBER 95

95

SHERIDAN COUNTY, MONTANA NO. 95

This map is compiled on 1967 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

3 300 000 FEET

R. 58 E. | R. 59 E.

(Joins sheet 92)

T. 31 N.

555 000 FEET

(Joins sheet 94)

ROOSEVELT COUNTY

NORTH DAKOTA

WILLIAMS COUNTY

SOIL SURVEY

BOUNDARY OF SOIL SURVEY

2 Miles

10000 Feet

5000

1

545 000 FEET

3 325 000 FEET

Scale 1:24000